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A METHOD FOR ADJUSTING MAINTENANCE FORECASTS TO ACCOUNT FOR PLA--ETC(U)
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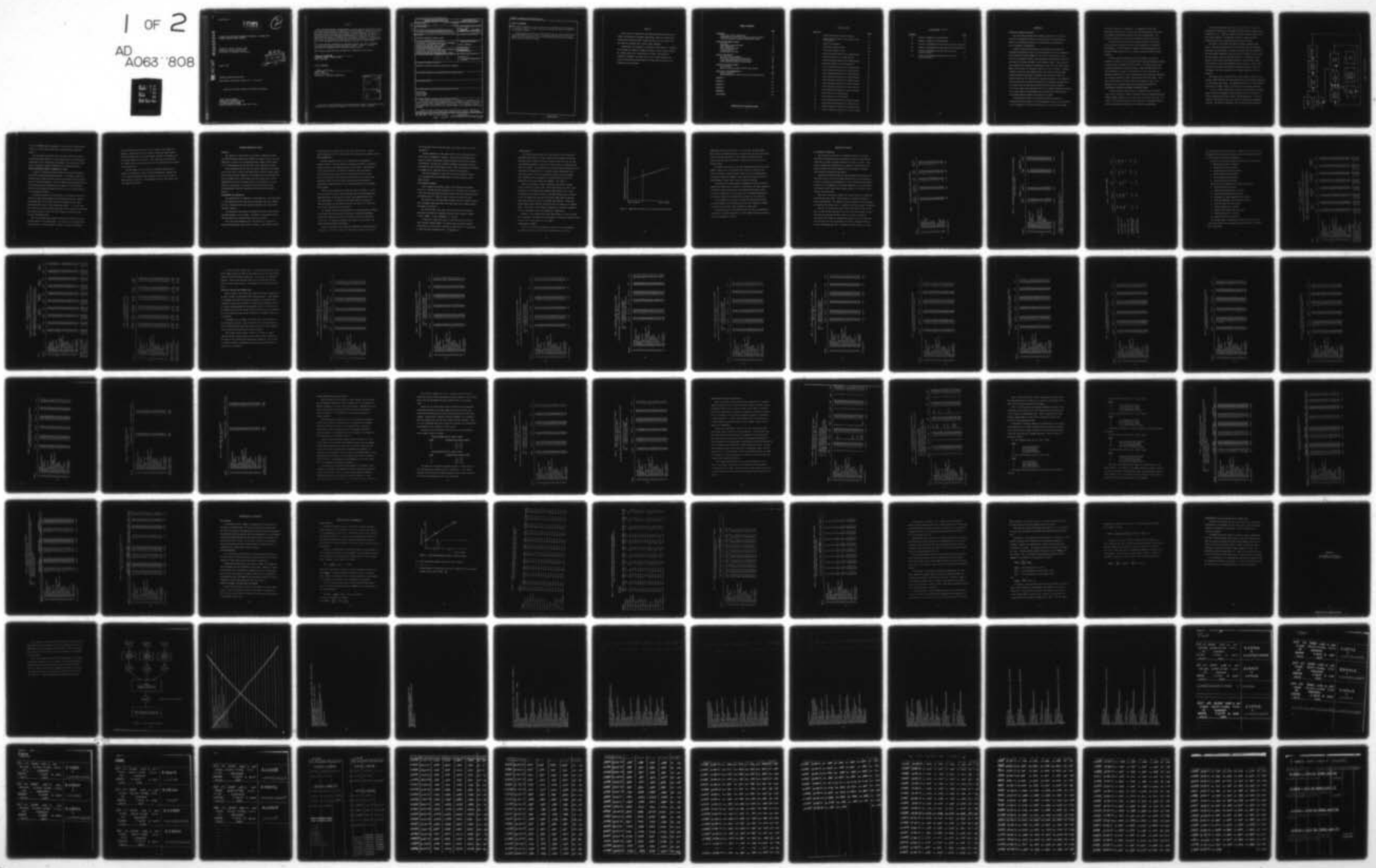

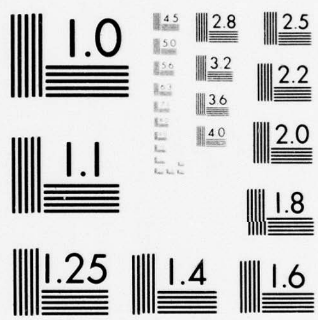

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LEVEL II

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A METHOD FOR ADJUSTING MAINTENANCE FORECASTS TO ACCOUNT FOR PLANNED AIRCRAFT SORTIE LENGTHS

Lawrence D. Howell, Captain, USAF
Engineering Specialties Division
Directorate of Equipment Engineering

August 1978

TECHNICAL REPORT ASD-TR-78-26

Final Report for Period 1 April 1977 - 1 June 1978

Approved for public release; distribution unlimited

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Lawrence D Howell

LAWRENCE D. HOWELL, Captain, USAF
Project Engineer

FOR THE COMMANDER

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This report describes the development of a technique for adjusting forecasted failure rates of developmental aircraft systems to account for the effect of the planned sortie lengths of the new aircraft. This technique utilizes maintenance data collected from the current inventory of comparison operational systems.

After all other factors have been scrutinized, the failures resulting in maintenance actions are plotted against average sortie lengths. (SEE REVERSE)

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Then linear regression is used to smooth chance variation and the intercept is related to cyclic or warm-up failure rates while the slope is related to time induced failures.

This technique is used to analyze failure rates for four aircraft types (three military and one civilian). Comparisons are made and it is recommended that this technique be used in forecasting failure rates of developmental military aircraft systems.

FOREWORD

This report was prepared in the Engineering Specialties Division (ENES), Directorate of Equipment Engineering, Deputy for Engineering, Aeronautical Systems Division, Wright-Patterson Air Force Base, Ohio. The work was performed under Project Number AFSD0161.

Appreciation is expressed to Lieutenant Colonel Donald C. Tetmeyer, who provided the impetus to begin the project, to Mrs. Sharon Nichols, Mr. Charles Begin, Mrs. Linda Skelton, and Mrs. Jean Achard for assistance throughout the study, and to the civilian industry and airline sources that provided some of the data that was used in the preparation of this report.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES (Cont'd)

BACKGROUND

HISTORICAL AIRCRAFT RELIABILITY

Ever since the government began buying large numbers of military aircraft from competing civilian aircraft production corporations the problem of forecasting reliability and maintenance requirements has been an important consideration.

As soon as data became available upon operational aircraft the unscheduled maintenance failure rate was analyzed in terms of maintenance-man-hours-per-flying-hour (MMH) for the aircraft weapon system. Then as new or replacement aircraft were considered, the competing contractors were asked to estimate the MMH of their proposed design. Since the total weapon system cost includes the maintenance costs, the lower the reported MMH the more likely the corporation would be to sell its model. Although companies did perform some demonstration tests (often utilizing highly trained personnel under ideal conditions) the estimates proved to be grossly inaccurate and costs greatly exceeded predictions. The credibility of the contractors' estimates soon waned as more manpower and spare parts were needed than had been made available based upon those estimates. As a result, spare parts shortages and lack of trained maintenance personnel led to lower mission accomplishment than forecasted and another method of reliability/maintainability forecasting was sought.

As maintenance officers and technicians gained experience in operational aircraft similar to the developmental aircraft, their opinions as to the numbers of men and time required to do each task were sought.

This source tended to be somewhat of a exaggeration since these operational personnel were concerned with having ample people and parts to accomplish the requested missions and thus "looking good." Contractors, predictably, criticized this method as biased and unfair.

In any case both of the previous sources proved to be less than precise and cost forecasts and comparisons continued to be difficult and imprecise. With the advent of computers and the Maintenance Data Collection (MDC) system the use of computer forecasting models became feasible.

The MDC system was developed in the late 1950s as a system of documents or forms to record unscheduled and routine maintenance performed on each aircraft belonging to the Air Force.[1] The other services also developed maintenance collection systems. Under the MDC system, each time maintenance or support is performed on or for an aircraft, the repairmen document the aircraft identification, what tasks were performed, and how many repairmen of each type worked for what time period. This data is then stored on computer tapes for a variety of uses. See Appendix B for a complete description reproduced from AFM 66-1.[2]

DEVELOPMENTAL AIRCRAFT MAINTENANCE FORECASTING MODELS

In the mid-sixties the Air Force, in conjunction with the Rand Corporation, developed a series of computer simulation program frameworks (CONCUR, CONVOL, SAMSON II, etc)[3] and later, by contract with CACI, Inc., (LCOM).[4] The Army[5] and Navy[6] also have made use of simulation models to predict maintainability/reliability and mission accomplishment.

The current simulation model used by the Air Force for manpower requirements forecasting is the Logistics Composite Model (LCOM) written in Simscript II.5.[7] LCOM is a general aircraft or weapons system model which can be adapted to a particular aircraft or weapon system by incorporating the data concerning that particular aircraft.

The inputs to this model are the daily mission schedules which define: when the aircraft are to fly and for how long; the scheduled maintenance servicing tasks, including the number and time distribution that maintenance repairmen of each specialty are required for each task; and what support resources each task utilizes. In addition the user defines the corrective maintenance networks to include tasks, times, and resources to repair each subsystem when it breaks. Failure clocks defining the frequency with which each subsystem requires corrective maintenance, the initial quantities and resupply times are also user supplied.

With these inputs, along with the initial number of aircraft to be assigned, LCOM simulates the flying operations for the modeled organization for any desired time period. See AFHRL-TR-74-97(II) for a more complete description of LCOM.[8] Figure 1 illustrates the simulation technique.

In order to define the failure clocks for the subsystems of developmental aircraft the engineer collects whatever data is available from similar operational aircraft, usually from the MDC system. This data normally comes directly from an air base that operates the comparison aircraft. The AFM 66-1 maintenance data is then processed through a

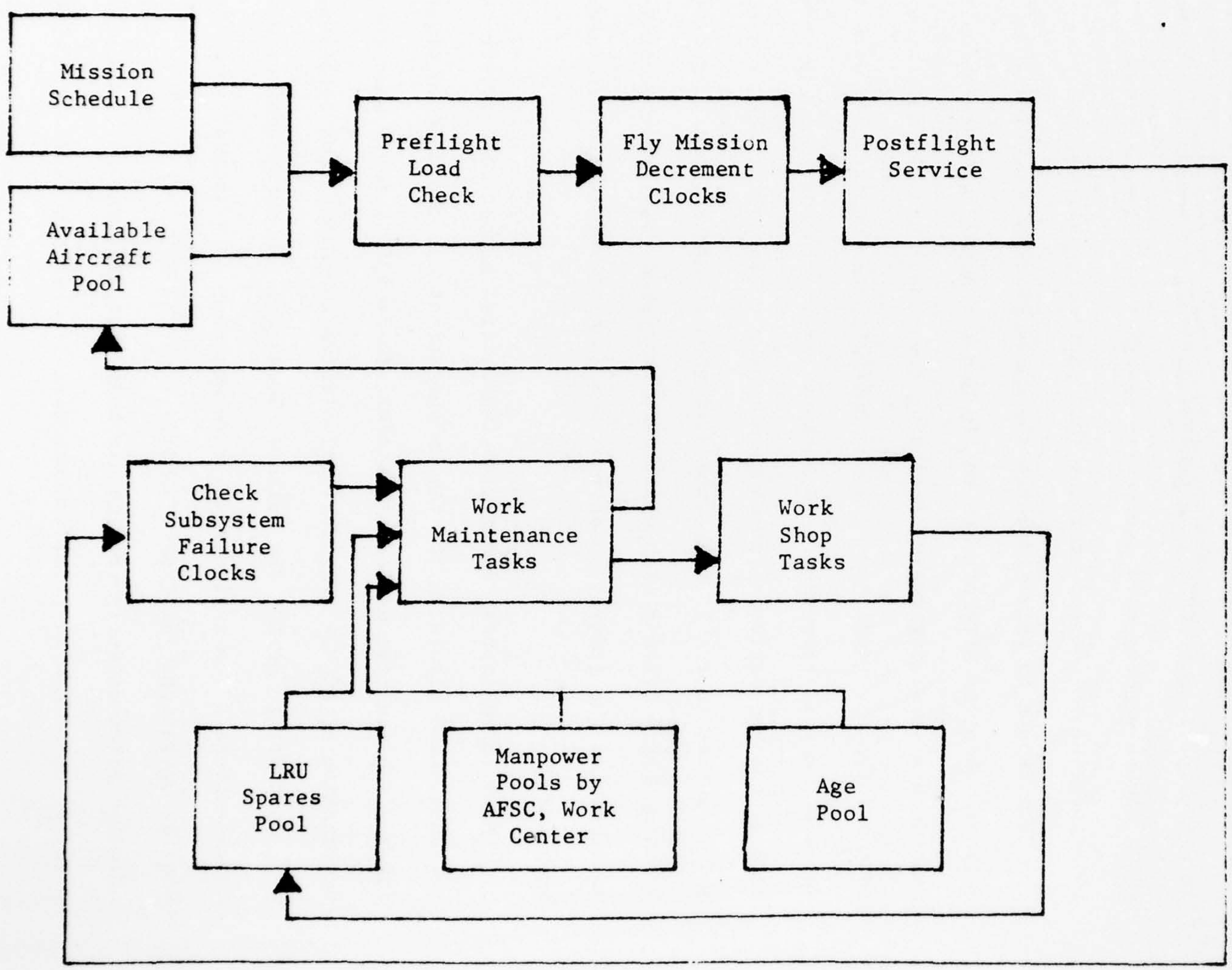


Figure 1. How LCOM Works

series of FORTRAN computer programs written for the CDC 6600 computer to put it in a form that can be used in developing the simulation inputs.[9]

The task times and failure rates are then analyzed by aircraft systems development engineers to make adjustments for differences and improvements in the developmental subsystems. This new data is then used to develop the computer networks of the simulated aircraft.

PROBLEM ENCOUNTERED DURING A COMPARABILITY STUDY

A number of difficulties arise during this process that must be overcome by the simulation design engineer. For instance, data from different bases flying the same aircraft may display different failure rates for the same equipment. Since the LCOM simulation normally bases the forecasted failure distribution upon number of sorties between failures, this parameter is highly sensitive to the air base selected as the comparison location.

One possible solution to this problem is to average the data from several air bases before making the comparability analysis. However, this method does not take into account the possibility that these differences may be due to other than random chance. If, on the other hand, some of the factors causing different failure rates can be measured we can take them into account in future studies and produce a more accurate forecasting model.

One of the factors that possibly affects the failure rate is the average length of the sorties flown. For instance, if the takeoff and climb portion of a sortie produces a failure rate that is different

from the failure rate during the cruise portion of the flight, and perhaps a third failure rate is prevalent during the landing phase, then the average number of sorties between failures is dependent upon the average length of the sorties. This could also be described as the failure rate during warm-up period for the equipment and the steady-state failure rate.

Thus the intent of this study is to determine whether sortie length is a significant factor in making comparability analyses and, if so, what the simulation design engineer can do to account for an expected sortie length for a developmental aircraft that differs from the comparison aircraft.

PLANNING EXPERIMENTAL DESIGN

OBJECTIVE

The objective of this study is to provide a technique by which the LCOM simulation engineer can readjust the failure rates of aircraft subsystems to account for a planned difference between sortie length of the developmental aircraft and that of the comparison aircraft.

Since maintenance data is kept by systems, subsystems, and components, we are able to collect and analyze data for each aircraft system. The aircraft parts are tracked by a five-digit work unit code when the first two digits refer to the system, the third digit refers to the subsystem and the last two digits refer to the components. For the purpose of this study, I will group the data by two-digit level. Technical Manual TO-00-20-2 explains the data collection system in detail.[10]

REQUIREMENTS AND CONSTRAINTS

The requirements for completion of this study are: data from three or more different aircraft that can be associated with sortie length, the use of computer statistical analysis packages, and computer data reduction programs.

The constraints that persist throughout the study include limited time and manpower to do the study. The source of information will be the MDC system and civilian aircraft contractor sources.

Since the prime immediate use of the results is to assist in a modeling developmental cargo airlift aircraft, I have limited the data

collection effort to large cargo, bomber and civil aircraft. However, the techniques described in this report can be used for other models as well.

BASIC ASSUMPTIONS

Several assumptions apply to the planned use of regression to analyze the data. The most important assumption pertains to the warm-up period for each of the systems analyzed in this study. The assumption is that every sortie is of sufficient length to cover the warm-up period and allow the system to reach its steady-state failure rate. Thus, if we discount other effects and assume that cyclic effects will stabilize within the sortie flight time then the average number of maintenance actions per sortie can be related linearly with increasing sortie length.

There is some precedent for using this type of analysis. I would like to point out that Mr. Maurice Shurman from the Boeing Company has demonstrated that field data does support the changing failure rate with time theory.[11] According to this study failure rates seem to stabilize between ten and twenty percent of the time into a sortie for the aircraft with which we are concerned.

Mr. Shurman performs his analysis upon the data grouped by failures within each aircraft type and then develops a common time dependent failure rate equation to predict the failure rate at any time within the sortie. His equation is general and relates to all aircraft and unspecified maintenance requirements.

Kern and Drnas have also studied how operational influences affect reliability. From their report one might gain an insight into some of

the operational factors that may change the failure rates of avionics equipment.[12]

Another assumption is that other factors can be divorced from the effect we are attempting to analyze. Such factors as differences in mission profiles, maintenance concepts (methods and policies), weather (environment), aircraft age, aircrew techniques, utilization rates and any others may also offset failure rates. These factors must be isolated or assumed not to completely hide the effect we are studying.

The third assumption is that the cyclic and flying hour effects can be measured and that the MDC system is accurate enough to show these effects.

DATA COLLECTION METHOD

From a commercial airplane company I have obtained maintenance data for a civilian aircraft collected for two different sortie lengths.[13] I have also acquired data from B-52D aircraft from three bases operating in Southeast Asia.[14] These two sets of data were grouped by base.

One group of the civilian planes (Boeing 727s) flew commuter flights only (averaging .566 hours) while the other group flew standard flights (averaging 1.327 hours).

The B-52D aircraft data comes from three bases each flying the same mission profile but requiring different sortie lengths (U-TAPAO - 4 hours, KADENA - 8 hours, ANDERSEN - 11.5 hours).

In addition to these data sources I have obtained from the Air Force Logistics Command (AFLC) 16 computer tapes containing the MDC information for all Air Force C-141A and C-130E aircraft for the period of time June 1976 through May 1977. See Appendix A.

PLANNED ANALYSIS

The initial analysis plan is to take this data, which describes maintenance performed on aircraft flying the same mission profile but different sortie lengths for several different type aircraft, and then use regression programs to relate the failure rates to flying time and number of sorties. We can think of the total average maintenance actions per sortie as being made up of a constant portion (regression line intercept) which we will call maintenance actions per sortie (MAPS) and a variable portion (regression line slope) which we will call Maintenance Actions Per Flight Hour (MAPFH). See Figure 2.

Some of the causes for these differences may be that, during turn-on, electrical surges cause a short-term failure rate that is not indicative of the steady-state equipment usage failure rate. There is intensive low frequency vibration and shock during taxi and takeoff as well as significant vibration during the flight phases requiring high power settings, such as low altitude and climb-out. During the maximum gross weight take-off conditions there is longer use of maximum power. Also, there is the thermal instability of electronic equipment until the equipment reaches its steady-state temperature.

However, it is believed that after these warm-up or cyclic effects have stabilized, the flight enters the phase of relatively constant failure rates for the cruise portion of the flight.

CLARIFICATION OF TERMS

Here we are defining a maintenance action to be any unscheduled (not routine) action or repair service performed by one or more

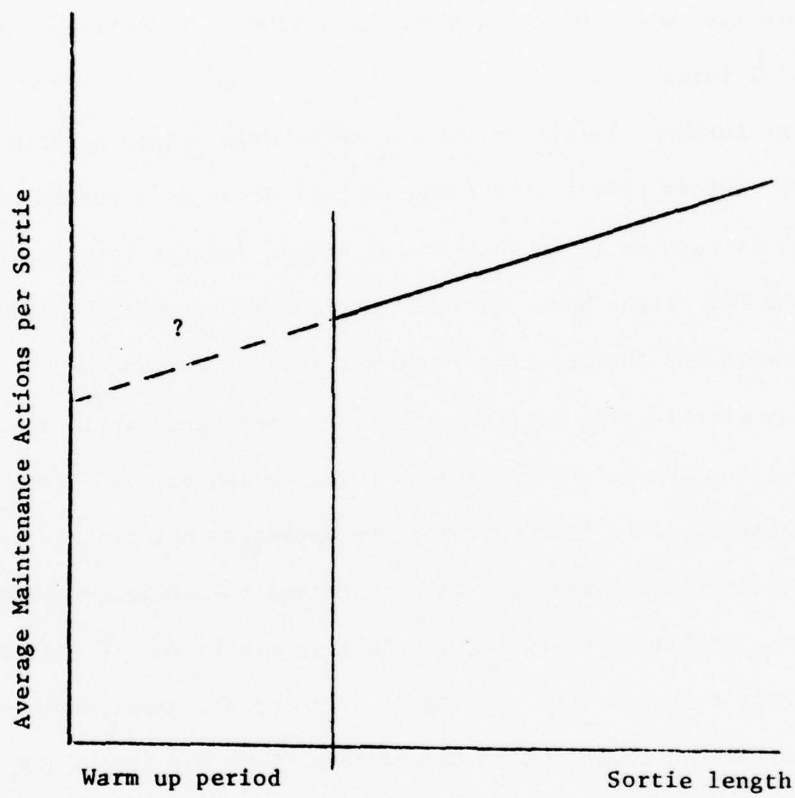


Figure 2. Maintenance Actions (Cyclic and Flying Hour Factors)

maintenance men and documented by a Form 349 under the MDC system. Each action is documented against the proper work unit code and entered into the records regardless of time required to make the repair. Failure rate and average maintenance actions per sortie are used as parallel terms.

As further clarification, the term "Maintenance Actions Per Sortie (MAPS)" refers only to the failures that occur as a result of the cyclic or warm-up (transient-state) effect and the term "Maintenance Actions Per Flight Hour (MAPFH)" refers only to the failures that are time dependent (steady state) and not related to warm-up.

By plotting the average number of maintenance actions per sortie against the average sortie length for each system, and using regression to smooth the data fluctuations, the estimated maintenance actions per sortie (regression line intercept) and the estimated maintenance actions per flight hour (regression line slope) can be calculated.

This technique can be used to estimate the maintenance actions per sortie (MAPS) and the Maintenance Actions Per Flight Hour (MAPFH) for each of the aircraft types considered in this study.

From this analysis an adjustment factor can then be determined to account for a planned difference in sortie lengths between the developmental and comparison aircraft.

ANALYSIS AND RESULTS

DATA REDUCTION TECHNIQUES

The civilian aircraft data is combined by systems to coincide with military designations and is presented in Table 1 along with the B-52D data in terms of average maintenance actions per sortie. This table is computed by dividing the total number of failures for each system, aircraft and sortie length by the total number of sorties flown during the considered time period.

Since the civilian aircraft all flew the same mission profile and the B-52D aircraft all flew the same mission profile, and each source of data is relatively self-consistent as far as weather and maintenance concepts, it is reasonable to use linear regression to test the effect of different sortie lengths upon average numbers of failures for each aircraft type and system.

Since the civilian data yields only two data points per system and the B-52D data only three, I have limited the regression analysis to linear relationships. The results of these regressions and data summary are presented in Tables 2 and 3. Regression line plots appear in Appendix C.

Data for the C-130E and C-141A aircraft was obtained from the MDC input to AFLC and was collected by each aircraft serial number and date. This data was processed through a series of computer programs to provide the total number of maintenance actions in each two-digit work unit code areas for the time periods June 1976 to September 1976 and October 1976 through May 1977. Analysis were made upon each of these

TABLE 1. AVERAGE MAINTENANCE ACTIONS PER SORTIE

System		.566 Hr Civilian 1	1.327 Hr Civilian 2	4 Hr B-52	8 Hr B-52	11.5 Hr B-52
11	Airframe	.040	.086	4.216	7.024	8.602
12	Fuselage	.079	.186	.592	.448	.909
13	Landing Gear	.041	.058	2.504	2.496	2.772
14	Flt Controls	.007	.015	3.616	2.721	3.289
23	Engines	.045	.090	3.712	7.504	8.522
41	Air Cond	.015	.025	.912	.944	1.403
42	Elec Pwr	.011	.018	1.296	1.848	2.013
44	Lighting	.077	.136	.652	.632	1.909
45	Hyd Pwr	.007	.013	1.396	2.152	2.404
46	Fuel	.003	.006	.868	.624	1.668
47	Oxygen	.010	.013	.208	.192	.299
51	Instruments	.006	.010	2.932	3.096	3.473
52	Autopilot	.004	.006	.752	.904	.817
63	UHF Comm	.025	.043	.684	.68	.782
74	Fire Cont	.004	.006	2.48	2.608	5.026
UHF + Interphone		.025	.043	1.152	1.296	1.392

TABLE 2. LINEAR REGRESSION RESULTS FOR BOEING 727 AND B-52D AIRCRAFT
(Data Grouped by Base)

		B-52D		Boeing 727	
System		MAPS*	MAPFH**	MAPS	MAPFH
11	Airframe	2.011	.586	.0057	.0604
12	Fuselage Compartments	.333	.040	0	.1406
13	Landing Gear	2.318	.035	.0284	.0223
14	Flight Controls***	1.419	.163	.0011	.0105
23	Engines	1.499	.649	.0115	.0591
41	Air Cond	.584	.064	.0076	.0131
42	Electrical Power Supply	.963	.097	.0058	.0092
44	Lighting Systems	.217	.164	.0331	.0775
45	Hydraulic & Pneumatic Sys	.921	.136	.0025	.0079
46	Fuel Systems	.249	.103	.0008	.0039
47	Oxygen Supply	.141	.0118	.0078	.0039
51	Instruments	2.608	.0714	.0030	.0053
52	Autopilot	.7513	.0093	.0025	.0026
63	UHF Comm	.6135	.0131	.0116	.0237
74	Fire Cont	.770	.332	.0025	.0026
UHF + Interphone		1.029	.032	.0116	.0237

* MAPS = maintenance actions per sortie or cycle
** MAPFH = maintenance actions per flight hour
*** Using two sortie lengths from B-52 data (U-Tapao data excluded due to different reporting method)

TABLE 3. AIRCRAFT DATA SUMMARY

	Civilian 1	Civilian 2	B-52	B-52	B-52
Average Sortie Length	.566	1.327	4	8	11.5
Total Flight Hours	9539	50294	18,013	15,286	34,918
Total Sorties	16830	38062	4503	1911	3036
Number of Aircraft	6	22	35	20	42
Average Sorties per Aircraft per Month	233.8	144.2	21.4	18.9	12.0
Flight Hours per Aircraft per Month	132.5	190.5	85.8	127.4	138.6

sets of data and upon the one year data combination for each aircraft. The method of data reduction to obtain the total maintenance actions for each system is presented in Appendix A.

The data for the C-141A aircraft came from six Air Force bases:

1. McGuire AFB NJ with 47 aircraft.
2. Travis AFB CA with 41 aircraft.
3. Charleston AFB SC with 99 aircraft.
4. McCord AFB WA with 40 aircraft.
5. Norton AFB CA with 50 aircraft.
6. Altus AFB OK with 16 aircraft.

The data for the C-130E aircraft came from ten bases:

1. Pope AFB NC with 38 aircraft.
2. Elmendorf AFB Alaska with 15 aircraft.
3. Little Rock AFB AR with 64 aircraft.
4. Mildenhall Air Base England with 16 aircraft.
5. Clark AFB Philippine Islands with 18 aircraft.
6. Yokota AB Japan with 18 aircraft.
7. Andrews AFB MD with 1 aircraft.
8. Elmendorf AFB Alaska with 10 aircraft.
9. McCord AFB WA with 21 aircraft.
10. Langley AFB VA with 6 aircraft.

The average number of maintenance actions per sortie for the C-141A and C-130E aircraft grouped by base are presented in Tables 4 and 5 respectively.

TABLE 4. C-130E DATA GROUPED BY BASE
(Jun 76 - May 77)
Average Maintenance Actions Per Sorties and Standard Deviations

Mean = Average number of maintenance actions per sortie
S.D. = Standard deviation of maintenanct actions per sortie

Base	Pope 38 acft		Rhein Mein 15 acft		Little Rock 64 acft		Mendehall 16 acft	
System	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
11 Airframe	.614	.318	.585	.287	.450	.219	.430	.173
12 Fuselage Compartments	.212	.158	.231	.074	.228	.107	.213	.094
13 Landing Gear	.191	.098	.189	.101	.186	.108	.142	.056
14 Flight Controls	.146	.100	.125	.048	.093	.043	.081	.038
22 Engine	.680	.241	.697	.255	.546	.277	.499	.236
24 Aux Power Plant	.114	.053	.086	.028	.065	.033	.060	.044
41 Air Cond	.197	.100	.209	.122	.140	.067	.129	.055
42 Electrical Power Supply	.132	.056	.144	.067	.081	.045	.080	.021
44 Lighting Systems	.151	.078	.136	.083	.137	.077	.111	.070
45 Hydraulic & Pneumatic Sys	.236	.132	.209	.080	.147	.093	.126	.042
46 Fuel Systems	.320	.155	.310	.118	.300	.190	.235	.064
47 Oxygen Supply	.048	.037	.046	.031	.040	.022	.041	.026
49 Misc Utilities	.117	.059	.115	.060	.062	.034	.051	.028
51 Instruments	.129	.050	.125	.049	.082	.035	.067	.029
52 Autopilot	.093	.040	.080	.038	.064	.039	.063	.034
61 Communications	.213	.066	.209	.134	.183	.077	.165	.060
65 IFF	.021	.019	.027	.028	.019	.021	.013	.013
71 Radio Navigation	.143	.058	.141	.076	.164	.069	.147	.068
72 Radar Navigation	.350	.105	.369	.202	.269	.114	.224	.056
Average Hrs Per Flight	2.647	.185	2.788	.934	3.538	.989	3.006	.393
Total Number of Sorties/Month	230.368	54.268	227.667	61.351	190.953	65.223	215.813	44.619
All Maintenance	4.041	1.537	3.907	1.503	3.131	1.210	2.850	.953
Average Hrs Per Month	51.442	9.859	51.639	8.333	53.618	7.862	55.417	6.775
Average Sorties Per Month	19.574	4.176	19.730	5.075	16.439	5.368	18.712	3.319

TABLE 4. C130E DATA GROUPED BY BASE (Cont'd)
(Jun 76 - May 77)
Average Maintenance Actions Per Sorties and Standard Deviations

Mean = Average number of maintenance actions per sortie
S.D. = Standard deviation of maintenance actions per sortie

Base	Clark 18 acft		Yokota 18 acft		Elmendorf 10 acft		McCord 21 acft		Langley 6 acft	
System	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
11 Airframe	.618	.182	.369	.196	.379	.129	.436	.117	.752	.460
12 Fuselage Comp.	.393	.155	.138	.121	.265	.097	.221	.076	.305	.178
13 Landing Gear	.203	.044	.178	.104	.133	.039	.264	.084	.209	.174
14 Flight Controls	.159	.055	.119	.091	.114	.052	.111	.044	.159	.096
22 Engine	.731	.140	.384	.173	.419	.128	.501	.148	1.289	.508
24 Aux Power Plant	.093	.036	.078	.054	.083	.032	.089	.038	.136	.089
41 Air Cond.	.200	.074	.133	.075	.122	.037	.193	.057	.263	.223
42 Elect. Power Supply	.077	.025	.059	.049	.085	.025	.058	.030	.149	.121
44 Lighting Systems	.142	.060	.108	.122	.194	.096	.206	.060	.179	.124
45 Hyd. & Pneumatic Sys	.161	.034	.174	.093	.096	.049	.156	.068	.259	.158
46 Fuel Systems	.172	.057	.187	.092	.147	.072	.360	.093	.314	.200
47 Oxygen Supply	.072	.034	.043	.029	.034	.014	.052	.021	.062	.050
49 Misc Utilities	.076	.025	.045	.025	.057	.024	.065	.029	.169	.136
51 Instruments	.101	.035	.065	.042	.059	.021	.093	.038	.123	.059
52 Autopilot	.101	.051	.038	.022	.050	.023	.095	.046	.057	.025
61 Communications	.189	.052	.139	.061	.155	.084	.246	.062	.162	.110
65 IFF	.027	.039	.017	.012	.018	.013	.031	.025	.037	.025
71 Radio Navigation	.136	.041	.127	.070	.111	.046	.171	.063	.109	.055
72 Radar Navigation	.311	.091	.202	.098	.199	.076	.312	.072	.170	.143
Average Hrs Per Flight	2.837	.374	2.740	.202	2.013	.546	3.193	.383	2.453	.518
Total No. Sorties/Month	214.444	47.737	218.222	69.798	282.400	55.925	181.238	37.667	218.000	69.587
All Maintenance	3.863	.804	2.534	1.230	2.661	.611	3.570	.693	4.782	2.765
Ave. Hrs Per Month	51.295	7.460	52.869	11.521	48.420	7.265	50.420	7.542	45.325	7.270
Ave. Sorties Per Month	18.382	3.564	19.471	4.896	25.093	5.095	15.937	2.762	19.233	4.830

TABLE 5. C-141A DATA GROUPED BY BASE
(Jun 76 - May 77)
Average Maintenance Actions Per Sorties

System		McGuire 47 acft	Travis 41 acft	Charleston 49 acft	McCord 40 acft	Norton 50 acft	Altus 16 acft
11	Airframe	0.632	0.609	0.527	0.363	0.438	1.890
12	Fuselage Compartments	0.232	0.159	0.169	0.116	0.130	0.615
13	Landing Gear	0.375	0.307	0.273	0.216	0.221	1.020
14	Flight Controls	0.258	0.284	0.237	0.183	0.176	1.176
23	Engine	0.599	0.526	0.440	0.377	0.441	1.600
24	Aux Power Plant	0.083	0.059	0.050	0.043	0.046	0.157
41	Air Cond.	0.128	0.112	0.100	0.079	0.069	0.189
42	Electrical Power Supply	0.074	0.078	0.076	0.045	0.046	0.136
44	Lighting Systems	0.347	0.183	0.224	0.144	0.159	0.483
45	Hydraulic & Pneumatic Sys	0.185	0.221	0.164	0.088	0.089	0.305
46	Fuel Systems	0.126	0.119	0.129	0.130	0.108	0.206
47	Oxygen Supply	0.084	0.050	0.065	0.052	0.039	0.118
49	Misc Utilities	0.129	0.104	0.077	0.063	0.079	0.185
51	Instruments	0.124	0.135	0.117	0.101	0.098	0.272
52	Autopilot	0.116	0.112	0.096	0.109	0.088	0.187
61	Communications	0.213	0.225	0.194	0.213	0.168	0.353
65	IFF	0.020	0.015	0.017	0.015	0.010	0.020
71	Radio Navigation	0.141	0.134	0.128	0.144	0.110	0.255
72	Radar Navigation	0.216	0.214	0.181	0.167	0.134	0.333
Average Hrs Per Flight		3.846	3.856	3.455	3.319	3.706	3.608
Number of Sorties Per Month		295.532	278.220	331.224	326.450	307.900	174.563
Average Hrs Per Month		64.149	55.171	58.449	38.775	24.640	112.000
Average Sorties Per Month		19.702	13.366	16.388	13.750	5.900	35.500

For the C-141A and C-130E, since the data was available by aircraft serial number and the aircraft at each base do not fly the same mission lengths as did the B-52D and Boeing 727, each aircraft is considered separate. Thus we have 244 data points for the C-141A and 215 data points for the C-130E aircraft. See Appendix D for C-130E and C-141A data.

HANDLING OF MISSION AND ABNORMAL DATA

Data for some of the C-141A and C-130E aircraft was incomplete and so these aircraft are eliminated from further analysis. These missing or incomplete data stem from either undocumented or inaccurate data collection at base level, keypunch or computer tape production errors, or aircraft being grounded for long periods of time. In any case, it is assumed that due to the volume of data received intact, the analysis will not be greatly biased by the elimination of incomplete data from the analysis.

Furthermore, in an attempt to use data from aircraft which fly similar mission profiles I have removed the data from bases which fly only training missions since their usage of aircraft create different failure rates than those that fly airlift missions.

Since these airlift aircraft (C-141A and C-130E) fly global missions and have repairs made at many locations, each of which uses the same Air Force policies and maintenance regulations, the effects of weather, climate, and maintenance locational idiosyncrasies are assumed to be in balance.

TABLE 6. LINEAR REGRESSION RESULTS FOR C-130E AIRCRAFT
(Jun 76 - Sep 76)
Average Maintenance Actions per Cycle (Intercept) and Flt Hr (Slope)

S.E.E. = Standard error of estimate
C.V. = Coefficient of variation
R^2 = Linear correlation coefficient

System		Cycle	(S.E.E.)	Flt Hr	(S.E.E.)	R^2	C.V.
11	Airframe	.206	(.095)	.064	(.028)	.024	95.7
12	Fuselage Compartments	.227	(.055)	-.008	(.017)	.001	114.0
13	Landing Gear	.079	(.033)	.022	(.010)	.024	91.1
14	Flight Controls	.064	(.025)	.011	(.007)	.011	103.8
22	Engine	.375	(.122)	.041	(.036)	.006	99.2
24	Aux Power Plant	.076	(.018)	-.002	(.005)	.001	109.5
41	Air Cond	.105	(.037)	.014	(.011)	.008	102.6
42	Electrical Power Supply	.045	(.020)	.009	(.006)	.011	112.2
44	Lighting Systems	.136	(.031)	-.005	(.009)	.001	105.4
45	Hydraulic & Pneumatic Sys	.059	(.027)	.022	(.008)	.033	87.9
46	Fuel Systems	.141	(.049)	.030	(.015)	.021	84.9
47	Oxygen Supply	.035	(.011)	.002	(.003)	.001	118.6
49	Misc Utilities	.037	(.017)	.007	(.005)	.010	118.2
51	Instruments	.077	(.021)	.005	(.006)	.003	92.8
52	Autopilot	.060	(.017)	.000	(.005)	.000	120.3
61	Communications	.071	(.031)	.030	(.009)	.048	74.5
65	IFF	-.007	(.011)	.008	(.003)	.031	225.9
71	Radio Navigation	.067	(.024)	.016	(.007)	.024	83.6
72	Radar Navigation	.109	(.047)	.047	(.014)	.052	74.6

TABLE 7. REGRESSION RESULTS FOR C-130E AIRCRAFT
(Oct 76 - May 77)
Average Maintenance Actions per Cycle (Intercept) and Flt Hr (Slope)

S.E.E. = Standard error of estimate
C.V. = Coefficient of variation
R^2 = Linear correlation coefficient

System		Cycle	(S.E.E.)	Flt Hr	(S.E.E.)	R^2	C.V.
11	Airframe	-.009	(.098)	.206	(.031)	.170	63.6
12	Fuselage Compartments	.061	(.039)	.076	(.012)	.148	53.6
13	Landing Gear	-.057	(.029)	.095	(.009)	.330	50.5
14	Flight Controls	.064	(.024)	.025	(.008)	.048	67.7
22	Engine	.197	(.085)	.162	(.027)	.144	49.2
24	Aux Power Plant	.062	(.019)	.013	(.006)	.021	73.5
41	Air Cond	.034	(.030)	.054	(.009)	.132	60.0
42	Electrical Power Supply	.033	(.021)	.027	(.007)	.073	71.5
44	Lighting Systems	.019	(.024)	.050	(.008)	.164	57.0
45	Hydraulic & Pneumatic Sys	.071	(.035)	.046	(.011)	.073	66.5
46	Fuel Systems	-.019	(.045)	.112	(.015)	.221	56.3
47	Oxygen Supply	-.013	(.010)	.023	(.003)	.184	74.2
49	Misc Utilities	.046	(.019)	.016	(.006)	.032	80.3
51	Instruments	.021	(.014)	.028	(.005)	.150	54.0
52	Autopilot	.035	(.013)	.016	(.004)	.070	60.2
61	Communications	-.007	(.022)	.075	(.007)	.355	39.4
65	IFF	.009	(.008)	.005	(.003)	.018	133.7
71	Radio Navigation	.012	(.018)	.052	(.006)	.281	42.1
72	Radar Navigation	.012	(.032)	.102	(.010)	.328	39.1

TABLE 8. LINEAR REGRESSION RESULTS FOR C130E AIRCRAFT

Jun 76 - May 77

Average Maintenance Action Per Cycle (Intercept) and Flight Hour (Slope)

S.E.E. = Standard Error of Estimate
C.V. = Coefficient of Variation
R^2 = Linear Correlation Coefficient

System	Cycle	(S.E.E.)	Flt Hr	(S.E.E.)	R^2	C.V.
11 Airframe	.261	(.068)	.080	(.022)	.061	48.9
12 Fuselage Compartments	.165	(.036)	.027	(.012)	.025	53.1
13 Landing Gear	.002	(.024)	.063	(.008)	.243	45.4
14 Flight Controls	.091	(.019)	.009	(.006)	.010	58.6
22 Engine	.289	(.076)	.101	(.024)	.076	46.4
24 Aux Power Plant	.083	(.013)	.000	(.004)	.000	55.7
41 Air Cond	.092	(.025)	.025	(.008)	.046	52.9
42 Electrical Power Supply	.071	(.015)	.007	(.005)	.010	59.8
44 Lighting Systems	.089	(.023)	.019	(.007)	.031	57.1
45 Hydraulic & Pneumatic Sys	.090	(.027)	.027	(.009)	.045	57.5
46 Fuel Systems	.050	(.039)	.076	(.013)	.148	51.2
47 Oxygen Supply	.015	(.008)	.010	(.003)	.075	61.4
49 Misc Utilities	.059	(.015)	.006	(.005)	.009	68.5
51 Instruments	.049	(.013)	.015	(.004)	.058	50.4
52 Autopilot	.047	(.012)	.009	(.004)	.026	57.3
61 Communications	.048	(.021)	.048	(.007)	.194	38.0
65 IFF	.014	(.006)	.003	(.002)	.007	105.9
71 Radio Navigation	.021	(.015)	.042	(.005)	.262	37.6
72 Radar Navigation	.081	(.031)	.067	(.010)	.187	38.7
All Maintenance	1.61	(.371)	.605	(.120)	.111	37.4

TABLE 9. REGRESSION RESULTS FOR C-141A AIRCRAFT
(Jun 76 - Sep 76)
Average Maintenance Actions Per Cycle (Intercept) and Flt Hr (Slope)

S.E.E. = Standard Error of estimate
C.V. = Coefficient of variation
R^2 = Linear correlation coefficient

System		Cycle	(S.E.E.)	Flt Hr	(S.E.E.)	R^2	C.V.
11	Airframe	.750	(.283)	-.034	(.074)	.001	104.3
12	Fuselage Compartments	.261	(.084)	-.022	(.022)	.004	107.7
13	Landing Gear	.423	(.127)	-.030	(.033)	.003	94.4
14	Flight Controls	.411	(.138)	-.037	(.036)	.004	116.6
23	Engine	.405	(.192)	.036	(.050)	.002	81.4
24	Aux Power Plant	.030	(.027)	.008	(.007)	.005	103.7
41	Air Cond	.062	(.063)	.010	(.016)	.001	146.2
42	Electrical Power Supply	.030	(.028)	.012	(.007)	.011	87.0
44	Lighting Systems	.230	(.075)	-.001	(.020)	.000	75.4
45	Hydraulic & Pneumatic Sys	.060	(.053)	.023	(.014)	.011	82.7
46	Fuel Systems	.092	(.032)	.005	(.008)	.001	66.9
47	Oxygen Supply	.086	(.050)	-.007	(.013)	.001	186.2
49	Misc Utilities	.014	(.029)	.021	(.008)	.032	70.4
51	Instruments	.109	(.031)	.001	(.008)	.000	63.5
52	Autopilot	.073	(.027)	.006	(.007)	.003	63.7
61	Communications	.206	(.045)	.001	(.012)	.000	51.1
65	IFF	.001	(.012)	.004	(.003)	.006	181.0
71	Radio Navigation	.145	(.034)	-.005	(.009)	.001	60.8
72	Radar Navigation	.088	(.045)	.027	(.012)	.021	54.5

TABLE 10. LINEAR REGRESSION RESULTS FOR C-141A AIRCRAFT
(Oct 76 - May 77)
Average Maintenance Actions per Cycle (Intercept) and Flt Hr (Slope)

S.E.E. = Standard error of estimate
C.V. = Coefficient of variation
R^2 = Linear correlation coefficient

System		Cycle	(S.E.E.)	Flt Hr	(S.E.E.)	R^2	C.V.
11	Airframe	.321	(.321)	.087	(.089)	.004	86.6
12	Fuselage Compartments	.050	(.106)	.044	(.029)	.009	86.7
13	Landing Gear	.133	(.147)	.060	(.041)	.009	72.2
14	Flight Controls	.109	(.219)	.057	(.061)	.004	118.4
23	Engine	.182	(.261)	.112	(.072)	.010	76.2
24	Aux Power Plant	-.007	(.033)	.021	(.009)	.021	83.5
41	Air Cond	.010	(.035)	.029	(.010)	.036	52.1
42	Electrical Power Supply	.049	(.024)	.006	(.007)	.003	59.1
44	Lighting Systems	.010	(.093)	.065	(.026)	.025	65.6
45	Hydraulic & Pneumatic Sys	-.024	(.066)	.055	(.018)	.036	65.0
46	Fuel Systems	.088	(.040)	.015	(.011)	.007	47.8
47	Oxygen Supply	.038	(.023)	.008	(.006)	.006	60.2
49	Misc Utilities	-.003	(.035)	.029	(.010)	.037	58.0
51	Instruments	.061	(.039)	.021	(.011)	.015	49.3
52	Autopilot	.066	(.032)	.015	(.009)	.011	45.5
61	Communications	.102	(.048)	.033	(.013)	.025	37.2
65	IFF	.003	(.009)	.004	(.003)	.010	91.7
71	Radio Navigation	.054	(.039)	.026	(.011)	.023	45.2
72	Radar Navigation	.069	(.051)	.036	(.014)	.026	43.7

TABLE 11. LINEAR REGRESSION RESULTS FOR C-141A AIRCRAFT
(Jun 76 - May 77)
Average Maintenance Actions Per Cycle (Intercept) and Flight Hour (Slope)

S.E.E. = Standard Error of Estimate
C.V. = Coefficient of variation
R^2 = Linear Correlation Coefficient

System		Cycle	(S.E.E.)	Flt Hr	(S.E.E.)	R^2	C.V.
11	Airframe	-.087	(.121)	.166	(.033)	.100	34.2
12	Fuselage Compartments	-.040	(.048)	.055	(.013)	.073	43.1
13	Landing Gear	-.001	(.073)	.077	(.020)	.063	37.8
14	Flight Controls	-.005	(.063)	.064	(.017)	.057	40.3
23	Engine	-.107	(.106)	.160	(.029)	.120	32.3
24	Aux Power Plant	-.033	(.021)	.025	(.006)	.073	55.2
41	Air Cond	-.019	(.026)	.032	(.007)	.081	39.1
42	Electrical Power Supply	.012	(.018)	.014	(.005)	.036	41.4
44	Lighting Systems	-.079	(.075)	.080	(.020)	.064	50.8
45	Hydraulic & Pneumatic Sys	-.113	(.050)	.072	(.014)	.110	48.7
46	Fuel Systems	.093	(.031)	.008	(.008)	.004	36.6
47	Oxygen Supply	.001	(.019)	.016	(.005)	.038	48.6
49	Misc Utilities	-.084	(.025)	.048	(.007)	.178	40.3
51	Instruments	.021	(.023)	.026	(.006)	.069	29.4
52	Autopilot	.048	(.026)	.015	(.007)	.021	35.8
61	Communications	.110	(.037)	.025	(.010)	.027	26.4
65	IFF	.004	(.009)	.003	(.002)	.008	80.8
71	Radio Navigation	.063	(.030)	.018	(.008)	.021	34.0
72	Radar Navigation	.035	(.041)	.040	(.011)	.055	32.5
All Maintenance		-.201	(.619)	.919	(.169)	.116	28.6

TABLE 12. LINEAR REGRESSION RESULTS FOR C-130E AIRCRAFT
(Data Grouped by Base - Jun 76 - Sep 76)

System		Cycle	(S.E.E.)	Flt Hr	(S.E.E.)	R^2	C.V.
11	Airframe	.238	(.322)	.063	(.097)	.040	53.3
12	Fuselage Compartments	.271	(.184)	-.018	(.055)	.011	64.0
13	Landing Gear	-.028	(.151)	.062	(.045)	.157	63.8
14	Flight Controls	.080	(.084)	.008	(.025)	.011	57.3
22	Engine	.544	(.547)	.013	(.164)	.001	68.3
24	Aux Power Plant	.124	(.053)	-.016	(.016)	.092	53.0
41	Air Cond	-.006	(.170)	.060	(.051)	.120	66.1
42	Electrical Power Supply	.061	(.086)	.047	(.026)	.250	68.2
44	Lighting Systems	.147	(.121)	-.006	(.036)	.003	69.3
45	Hydraulic & Pneumatic Sys	.084	(.103)	.016	(.031)	.026	55.6
46	Fuel Systems	-.017	(.249)	.088	(.075)	.123	67.5
47	Oxygen Supply	.063	(.030)	-.007	(.009)	.063	56.8
49	Misc Utilities	.052	(.055)	.003	(.017)	.004	63.6
51	Instruments	.074	(.080)	.006	(.024)	.006	63.4
52	Autopilot	.082	(.064)	-.009	(.019)	.020	86.9
61	Communications	.086	(.122)	.026	(.037)	.047	52.6
65	IFF	-.017	(.025)	.013	(.007)	.234	72.6
71	Radio Navigation	.112	(.077)	.000	(.023)	.000	50.4
72	Radar Navigation	-.025	(.215)	.092	(.064)	.168	57.7

TABLE 13. LINEAR REGRESSION RESULTS FOR C-130E AIRCRAFT
(Data Grouped by Base - Oct 76 - May 77)

System		Cycle	(S.E.E.)	Flt Hr	(S.E.E.)	R^2	C.V.
11	Airframe	-.289	(.667)	.360	(.226)	.202	51.5
12	Fuselage Compartments	.211	(.149)	.035	(.050)	.045	27.9
13	Landing Gear	.035	(.118)	.069	(.040)	.232	29.0
14	Flight Controls	.024	(.107)	.048	(.036)	.151	37.8
22	Engine	.601	(.912)	.085	(.309)	.008	62.7
24	Aux Power Plant	.007	(.311)	.049	(.105)	.022	120.4
41	Air Cond	-.081	(.242)	.113	(.082)	.159	57.1
42	Electrical Power Supply	.045	(.101)	.028	(.034)	.062	46.8
44	Lighting Systems	.030	(.208)	.060	(.070)	.067	59.6
45	Hydraulic & Pneumatic Sys	.053	(.272)	.067	(.092)	.050	64.2
46	Fuel Systems	-.037	(.235)	.120	(.080)	.184	44.0
47	Oxygen Supply	-.018	(.113)	.033	(.038)	.070	83.5
49	Misc Utilities	.112	(.113)	-.001	(.038)	.000	60.6
51	Instruments	.085	(.060)	.010	(.020)	.022	30.8
52	Autopilot	.061	(.030)	.007	(.010)	.041	21.5
61	Communications	-.069	(.212)	.110	(.072)	.189	49.6
65	IFF	.031	(.020)	-.003	(.007)	.015	50.9
71	Radio Navigation	.055	(.068)	.037	(.023)	.203	24.5
72	Radar Navigation	.077	(.124)	.084	(.042)	.286	22.5

TABLE 14. LINEAR REGRESSION RESULTS FOR C-130E AIRCRAFT
(Data Grouped by Base - Jun 76 - May 77)

System		Cycle	(S.E.E.)	Flt Hr	(S.E.E.)	R^2	C.V.
11	Airframe	.584	(.256)	-.023	(.087)	.009	25.4
12	Fuselage Compartments	.273	(.141)	-.006	(.048)	.002	28.2
13	Landing Gear	-.096	(.122)	.106	(.042)	.447	29.8
14	Flight Controls	.170	(.051)	-.016	(.017)	.095	21.2
22	Engine	.747	(.539)	-.032	(.184)	.004	42.4
24	Aux Power Plant	.161	(.041)	-.026	(.014)	.300	23.9
41	Air Cond	.139	(.101)	.015	(.034)	.023	28.3
42	Electrical Power Supply	.119	(.072)	-.007	(.025)	.009	37.3
44	Lighting Systems	.200	(.066)	-.017	(.022)	.065	22.2
45	Hydraulic & Pneumatic Sys	.277	(.110)	-.038	(.038)	.116	34.2
46	Fuel Systems	.080	(.135)	.063	(.046)	.190	26.4
47	Oxygen Supply	.072	(.028)	-.009	(.009)	.105	30.8
49	Misc Utilities	.176	(.077)	-.033	(.026)	.167	49.4
51	Instruments	-.168	(.157)	.100	(.053)	.304	66.2
52	Autopilot	.005	(.043)	.024	(.015)	.253	29.4
61	Communications	-.011	(.084)	.073	(.029)	.444	21.8
65	IFF	-.014	(.028)	.014	(.009)	.221	51.8
71	Radio Navigation	.044	(.024)	.033	(.008)	.682	8.7
72	Radar Navigation	.056	(.133)	.077	(.045)	.262	24.7

TABLE 15. LINEAR REGRESSION RESULTS FOR C-141A AIRCRAFT
(Data Grouped by Base - Jun 76 - Sep 76)

System		Cycle	(S.E.E.)	Flt Hr	(S.E.E.)	R^2	C.V.
11	Airframe	.925	(3.519)	-.043	(.935)	.001	86.2
12	Fuselage Compartments	.481	(1.113)	-.068	(.296)	.013	92.7
13	Landing Gear	.844	(2.056)	-.121	(.546)	.012	98.7
14	Flight Controls	.825	(2.105)	-.124	(.559)	.012	109.8
23	Engine	.335	(2.460)	.081	(.653)	.004	72.2
24	Aux Power Plant	-.026	(.198)	.025	(.052)	.052	56.0
41	Air Cond	-.012	(.270)	.032	(.072)	.046	47.2
42	Electrical Power Supply	.004	(.224)	.020	(.059)	.028	51.9
44	Lighting Systems	.228	(.828)	.007	(.220)	.000	61.3
45	Hydraulic & Pneumatic Sys	.089	(.529)	.019	(.141)	.005	60.9
46	Fuel Systems	.214	(.253)	-.025	(.067)	.033	39.1
47	Oxygen Supply	.167	(.369)	-.024	(.098)	.015	91.6
49	Misc Utilities	-.065	(.285)	.045	(.076)	.081	51.4
51	Instruments	.157	(.360)	-.008	(.096)	.002	52.9
52	Autopilot	.136	(.189)	-.009	(.050)	.008	34.5
61	Communications	.350	(.369)	-.036	(.098)	.032	32.0
65	IFF	-.023	(.036)	.010	(.010)	.216	45.0
71	Radio Navigation	.384	(.343)	-.064	(.091)	.111	45.2
72	Radar Navigation	.142	(.431)	.017	(.115)	.005	39.3

TABLE 16. LINEAR REGRESSION RESULTS FOR C-141A AIRCRAFT
(Data Grouped by Base - Oct 76 - May 77)

System		Cycle	(S.E.E.)	Flt Hr	(S.E.E.)	R^2	C.V.
11	Airframe	-.470	(6.825)	.350	(1.905)	.008	89.4
12	Fuselage Compartments	-.225	(2.271)	.135	(.634)	.011	90.6
13	Landing Gear	-.354	(3.330)	.217	(.929)	.013	80.9
14	Flight Controls	.142	(4.856)	.079	(1.355)	.001	117.1
23	Engine	-.223	(5.860)	.261	(1.636)	.006	84.3
24	Aux Power Plant	-.115	(.586)	.055	(.164)	.027	74.3
41	Air Cond	-.134	(.486)	.072	(.136)	.066	40.3
42	Electrical Power Supply	.010	(.380)	.019	(.106)	.008	50.4
44	Lighting Systems	-.602	(1.435)	.243	(.401)	.084	54.8
45	Hydraulic & Pneumatic Sys	-.585	(.855)	.216	(.239)	.170	46.5
46	Fuel Systems	.315	(.387)	-.046	(.108)	.044	26.5
47	Oxygen Supply	.069	(.242)	.000	(.067)	.000	35.4
49	Misc Utilities	-.293	(.453)	.113	(.126)	.166	41.7
51	Instruments	.032	(.787)	.034	(.220)	.006	52.9
52	Autopilot	.089	(.463)	.012	(.129)	.002	36.5
61	Communications	.126	(.768)	.032	(.214)	.005	32.9
65	IFF	.029	(.045)	-.003	(.013)	.015	25.9
71	Radio Navigation	.206	(.581)	-.012	(.162)	.001	36.8
72	Radar Navigation	-.039	(.750)	.071	(.209)	.028	35.8

TABLE 17. LINEAR REGRESSION RESULTS FOR C-141A AIRCRAFT
(Data Grouped by Base - Jun 76 - May 77)

System		Cycle	(S.E.E.)	Flt Hr	(S.E.E.)	R^2	C.V.
11	Airframe	-.838	(.614)	.372	(.169)	.619	15.8
12	Fuselage Compartments	-.235	(.321)	.109	(.088)	.338	26.2
13	Landing Gear	-.400	(.419)	.187	(.115)	.467	19.8
14	Flight Controls	-.207	(.326)	.119	(.089)	.373	18.7
23	Engine	-.660	(.376)	.312	(.103)	.753	10.4
24	Aux Power Plant	-.114	(.100)	.047	(.028)	.488	23.7
41	Air Cond	-.108	(.173)	.057	(.048)	.321	23.4
42	Electrical Power Supply	-.062	(.130)	.035	(.036)	.239	26.8
44	Lighting Systems	-.383	(.627)	.164	(.172)	.231	39.1
45	Hydraulic & Pneumatic Sys	-.415	(.402)	.155	(.110)	.397	35.4
46	Fuel Systems	.198	(.067)	-.021	(.018)	.299	7.3
47	Oxygen Supply	.012	(.148)	.013	(.041)	.031	33.6
49	Misc Utilities	-.244	(.121)	.092	(.033)	.720	17.6
51	Instruments	-.029	(.108)	.040	(.030)	.372	12.4
52	Autopilot	.053	(.100)	.014	(.027)	.083	12.6
61	Communications	.160	(.191)	.012	(.052)	.017	12.4
65	IFF	.012	(.030)	.001	(.008)	.006	25.6
71	Radio Navigation	.170	(.116)	-.011	(.032)	.036	11.7
72	Radar Navigation	-.069	(.263)	.069	(.072)	.234	19.0

TABLE 18. CORRELATIONS FOR C130E AIRCRAFT
Jun 76 - May 77

System		Average Sortie Length	Total Number of Sorties
11	Airframe	.247	-.517
12	Fuselage Compartments	.158	-.403
13	Landing Gear	.493	-.694
14	Flight Controls	.100	-.437
22	Engine	.276	-.468
24	Aux Power Plant	.004	-.345
41	Air Cond	.216	-.500
42	Electrical Power Supply	.100	-.359
44	Lighting Systems	.177	-.397
45	Hydraulic & Penumatic Sys	.211	-.431
46	Fuel Systems	.385	-.576
47	Oxygen Supply	.279	-.491
49	Misc Utilities	.093	-.345
51	Instruments	.242	-.467
52	Autopilot	.160	-.320
61	Communications	.441	-.589
65	IFF	.086	-.199
71	Radio Navigation	.512	-.573
72	Radar Navigation	.433	-.525
Average Sortie Length		1.000	-.710
Total Number of Sorties		-.710	1.000

TABLE 19. CORRELATIONS FOR C-141A AIRCRAFT
(Jun 76 - May 77)

System		Average Sortie Length	Total Number of Sorties
11	Airframe	.316	-.454
12	Fuselage Compartments	.271	-.314
13	Landing Gear	.250	-.396
14	Flight Controls	.240	-.389
23	Engine	.346	-.478
24	Aux Power Plant	.270	-.260
41	Air Cond	.284	-.353
42	Electrical Power Supply	.189	-.272
44	Lighting Systems	.254	-.282
45	Hydraulic & Pneumatic Sys	.332	-.325
46	Fuel Systems	.064	-.321
47	Oxygen Supply	.194	-.257
49	Misc Utilities	.422	-.418
51	Instruments	.262	-.332
52	Autopilot	.145	-.370
61	Communications	.165	-.401
65	IFF	.090	-.291
71	Radio Navigation	.146	-.388
72	Radar Navigation	.235	-.348
Average sortie length		1.000	-.398
Total number of sorties		-.398	1.000

LINEAR REGRESSION RESULTS AND ANALYSIS

Linear regression was performed for each aircraft type and system, and the resultant intercepts, slopes, variance and R^2 are presented in Tables 6 through 11 for C-130E and C-141A aircraft. Regression was also used on the airlift data grouped by base, and the results appear in Tables 12 through 17. Correlations of the data are presented in Tables 18 and 19.

The Coefficient of Variation (C.V.) is the relative variability, written as a fraction or percentage, and is defined as the standard deviation divided by the mean.[15] The squared linear correlation coefficient is used to express the ratio of explained variation to total variation.[16] The standard error of the estimate is a measure of the scatter about the regression curve.[17]

From the Linear Regression Results (Tables 6 through 11) it can be seen that for some systems the maintenance failure rate is somewhat sortie length related and for many others the sortie length does not account for much of the variation in maintenance requirements. In each case, this information is quite useful in determining what, if any, adjustment should be made in the forecasted failure rates of developmental aircraft. Some maintenance relationships to cycles and flight hours are graphically displayed in Appendix C.

As can be seen from the figures in Appendix C and Tables 2 and 6 through 11 the number of maintenance actions for nearly every system is largest for the B-52D. Also, for nearly every system the number of maintenance actions for the civilian aircraft is smallest. These observations hold true for both cyclic and flight hour related failures.

From Tables 12 through 17 it can be seen that the data for the C-130E and C-141A aircraft, when grouped by base, displays a base related effect that may overshadow the sortie length effect in this narrow range.

Whereas the civilian aircraft and the B-52D both flew consistent predetermined sorties of the same length and mission profile, each C-130E and C-141A aircraft fly more varied mission profiles and sortie lengths. Cargo airlift, airdrop, training, passenger, air evacuation, and other missions are flown by the C-130E and C-141A aircraft. Thus, it is not unexpected that there is much more variance in the maintenance requirements for the C-130E and C-141A aircraft.

The data for the C-130E and C-141A aircraft was also grouped by sortie length classes as follows:

For the C-130E (Jun 76 - May 77 data)

Class	Average Sortie Length (Hours)
1	0 - 2.5
2	2.5 - 3.5
3	3.5 - 4.5
4	4.5 - 7.0

For the C-141A (Jun 76 - May 77 data)

Class	Average Sortie Length (Hours)
1	0 - 3.0
2	3.0 - 3.5
3	3.5 - 4.0
4	4.0 - 7.0

The results of the linear regression analysis of these two data sets are presented in Tables 20 and 21 respectively. It is easily observed that the effects of this grouping by sortie length illustrate the cyclic and flying hour factors for each system.

TABLE 20. LINEAR REGRESSION RESULTS FOR C-141A AIRCRAFT
(Data grouped by Sortie Lengths)
Jun 76 - May 77
Average maintenance actions per cycle (Intercept) and Flt Hr (Slope)

S.E.E. = Standard error of estimate
C.V. = Coefficient of variation
R^2 = Linear correlation coefficient

System		Cycle	(S.E.E.)	Flt Hr	(S.E.E.)	R^2	C.V.
11	Airframe	-.182	(.083)	.189	(.024)	.970	5.0
12	Fuselage Compartments	-.074	(.013)	.064	(.004)	.994	2.5
13	Landing Gear	-.059	(.017)	.092	(.005)	.994	1.9
14	Flight Controls	-.017	(.024)	.068	(.007)	.980	3.2
23	Engine	-.110	(.037)	.162	(.010)	.992	2.3
24	Aux Power Plant	-.029	(.013)	.024	(.004)	.957	6.7
41	Air Cond	-.034	(.006)	.036	(.002)	.995	2.0
42	Electrical Power Supply	-.006	(.014)	.020	(.004)	.928	6.3
44	Lighting Systems	-.106	(.023)	.087	(.006)	.989	3.3
45	Hydraulic & Pneumatic Sys	-.130	(.010)	.077	(.003)	.997	2.2
46	Fuel Systems	.086	(.027)	.011	(.008)	.505	6.3
47	Oxygen Supply	-.016	(.007)	.021	(.002)	.982	3.6
49	Misc Utilities	-.072	(.020)	.045	(.006)	.969	6.8
51	Instruments	.040	(.025)	.021	(.007)	.820	6.3
52	Autopilot	.040	(.006)	.017	(.002)	.981	1.7
61	Communications	.115	(.010)	.024	(.003)	.970	1.5
65	IFF	-.002	(.002)	.005	(.001)	.970	4.0
71	Radio Navigation	.067	(.029)	.018	(.008)	.717	6.4
72	Radar Navigation	.013	(.027)	.047	(.008)	.950	4.4

TABLE 21. LINEAR REGRESSION RESULTS FOR C-130E AIRCRAFT
(Data grouped by Sortie Lengths)
Jun 76 - May 77
Average Maintenance Actions per Cycle (Intercept) and Flt Hr (Slope)

S.E.E. = Standard error of estimate
C.V. = Coefficient of variation
R^2 = Linear correlation coefficient

System		Cycle	(S.E.E.)	Flt Hr	(S.E.E.)	R^2	C.V.
11	Airframe	.272	(.024)	.074	(.007)	.985	2.5
12	Fuselage Compartments	.147	(.010)	.034	(.003)	.986	2.2
13	Landing Gear	.006	(.008)	.062	(.002)	.997	2.1
14	Flight Controls	.092	(.008)	.008	(.002)	.877	3.6
22	Engine	.354	(.056)	.086	(.015)	.940	4.8
24	Aux Power Plant	.084	(.021)	.001	(.006)	.013	13.4
41	Air Cond	.097	(.013)	.024	(.004)	.957	4.1
42	Electrical Power Supply	.074	(.006)	.007	(.002)	.889	3.5
44	Lighting Systems	.091	(.029)	.021	(.008)	.776	10.0
45	Hydraulic & Pneumatic Sys	.099	(.027)	.022	(.007)	.816	8.7
46	Fuel Systems	.086	(.139)	.064	(.039)	.582	25.6
47	Oxygen Supply	.020	(.003)	.009	(.001)	.980	3.6
49	Misc Utilities	.069	(.011)	.003	(.003)	.342	7.6
51	Instruments	.058	(.011)	.013	(.003)	.891	6.2
52	Autopilot	.051	(.008)	.007	(.002)	.825	6.2
61	Communications	.067	(.036)	.043	(.010)	.903	9.4
65	IFF	.018	(.004)	.002	(.001)	.516	9.2
71	Radio Navigation	.023	(.017)	.041	(.005)	.974	5.8
72	Radar Navigation	.069	(.012)	.070	(.003)	.995	2.2

FACTOR ANALYSIS RESULTS AND DISCUSSION

Also, a preliminary factor analysis was considered and a stepwise regression program used to check the relative impact of several factors including the total sorties flown, average sortie length, utilization in terms of flight hours and sorties per month, and the base of assignment. The results of this stepwise regression analysis are presented in Tables 22 and 23. A second order regression was checked but due to a large variance and limited range of sortie lengths, results did not appear to be meaningful.

The stepwise regressions (Tables 22 and 23) illustrate the need for further study in the area of factor analysis. As can be seen from these two tables the average monthly utilization of the aircraft and the total sorties flown seem to provide a much greater explanation of the variation in the average number of maintenance actions per sortie than does the average sortie length for C-130E and C-141A aircraft. However, these figures are quite often the result of maintenance rather than the drivers of it. If the aircraft is down for maintenance often, it cannot be utilized to fly as many missions or sorties as can the aircraft that requires less frequent maintenance.

Also, during peacetime the aircraft are not planned to fly as much and the flight crews may be more insistent upon having repairs accomplished before flight. During wartime or surge efforts the aircraft are often required to be utilized at the maximum level maintenance will permit.

TABLE 22. STEPWISE REGRESSION RESULTS FOR C-130E AIRCRAFT
(Data from Jun 76 - May 77)
Model Used is Average Maintenance Actions = Variable as Follows:

T - Total sorties for time period
B - Code for home base of aircraft
H - Average utilization in hours per month
S - Average utilization in sorties per month
L - Average sortie length for period

System		Step 1	(R^2)	Step 2	(R^2)	Step 3	(R^2)	Step 4	(R^2)	Step 5	(R^2)
11	Airframe	H	(.335)	L	(.403)	B	(.425)	T	(.426)	S	(.426)
12	Fuselage Compartments	H	(.225)	L	(.254)	B	(.257)	S	(.259)	T	(.262)
13	Landing Gear	T	(.468)	H(T→L)	(.538)	B	(.554)	S	(.558)	T	(.563)
14	Flight Controls	H	(.328)	S	(.343)	B	(.345)	T	(.345)	L	(.345)
22	Engine	H	(.242)	L	(.325)	T	(.334)	S	(.339)	B	(.339)
24	Aux Power Plant	H	(.259)	T	(.262)	L	(.267)	S	(.268)	B	(.268)
41	Air Cond	H	(.315)	L	(.364)	S	(.365)	T	(.365)	S	(.365)
42	Electrical Power Supply	H	(.251)	B	(.338)	L	(.343)	S	(.352)	T	(.355)
44	Lighting Systems	H	(.245)	L	(.281)	S	(.325)	B	(.352)	T	(.357)
45	Hydraulic & Pneumatic Sys	S	(.187)	H	(.238)	B	(.261)	L	(.262)	T	(.262)
46	Fuel Systems	S	(.357)	H	(.377)	B	(.381)	T	(.384)	L	(.384)
47	Oxygen Supply	T	(.241)	H(T→S)	(.284)	L	(.287)	B	(.289)	T	(.289)
49	Misc Utilities	H	(.235)	B	(.263)	L	(.270)	T	(.272)	S	(.273)
51	Instruments	T	(.218)	H	(.260)	B	(.279)	L	(.280)	S	(.281)
52	Autopilot	T	(.102)	L(T→S)	(.118)	B	(.119)	H	(.120)	T	(.120)
65	IFF	T	(.039)	B	(.062)	H	(.067)	S	(.069)	L	(.070)
71	Radio Navigation	T	(.329)	L(T→H)	(.354)	T	(.359)	S	(.361)	B	(.363)
72	Radar Navigation	S	(.284)	B(S→T)	(.312)	L(T→H)	(.333)	T	(.335)	S	(.335)
All Maintenance		H	(.392)	L	(.514)	B	(.519)	S	(.519)	T	(.520)

TABLE 23. STEPWISE REGRESSION RESULTS FOR C-141A AIRCRAFT
(Data from Jun 76 - May 77)
Model Used is Average Maintenance Actions = Variable as Follows:

T = Total sorties for time period
B = Code for home base of aircraft
H = Average utilization in hours per month
S = Average utilization in sorties per month
L = Average sortie length for period

System		Step 1	(R^2)	Step 2	(R^2)	Step 3	(R^2)	Step 4	(R^2)	Step 5	(R^2)
11	Airframe	S	(.244)	B	(.395)	H(S→L)	(.399)	T	(.399)	S	(.400)
12	Fuselage Compartments	B	(.237)	S	(.308)	T	(.309)	H(S→L)	(.310)	S	(.310)
13	Landing Gear	B	(.271)	S	(.394)	H(S→L)	(.404)	T	(.408)	S	(.408)
14	Flight Controls	S	(.176)	B	(.280)	H(S→L)	(.291)	S	(.298)	T	(.298)
22	Engine	S	(.244)	B	(.340)	T	(.343)	L(S→H)	(.350)	S	(.354)
24	Aux Power Plant	B	(.158)	S	(.208)	H	(.212)	T	(.212)	L	(.212)
41	Air Cond	B	(.299)	T	(.371)	L	(.372)	S	(.372)	H	(.378)
42	Electrical Power Supply	B	(.224)	T	(.263)	H(T→L)	(.267)	S	(.276)	T	(.281)
44	Lighting Systems	B	(.288)	T	(.327)	L	(.328)	H	(.328)	S	(.328)
45	Hydraulic & Pneumatic Sys	B	(.346)	S	(.406)	L(S→H)	(.413)	S	(.415)	T	(.416)
46	Fuel Systems	T	(.103)	H	(.113)	B	(.116)	S(B→L)	(.140)	B	(.143)
47	Oxygen Supply	B	(.203)	T	(.238)	S	(.239)	H	(.239)	L	(.247)
49	Misc Utilities	B	(.241)	S	(.384)	L(S→H)	(.406)	S	(.411)	T	(.412)
51	Instruments	B	(.122)	S	(.205)	L(S→H)	(.213)	S	(.222)	T	(.225)
52	Autopilot	S	(.149)	B	(.178)	H(S→L)	(.190)	T	(.190)	S	(.190)
65	IFF	T	(.085)	B	(.116)	S	(.127)	H	(.131)	L	(.138)
71	Radio Navigation	T	(.150)	B	(.164)	H	(.168)	S	(.169)	L	(.183)
72	Radar Navigation	B	(.252)	T	(.326)	H	(.326)	L	(.326)	S	(.326)

All Maintenance

Thus, it follows that for a planned consistent utilization rate this type approach may be useful, but in practice, utilization is far less certain than the expected sortie lengths.

Also, it need be noted, the stepwise regression analyses of the C-130E and C-141A aircraft, in no case explains more than about half of the variation in maintenance data. Thus, we might look to other factors, random chance, or data error as reasons for much of the variation in the maintenance data.

An Analysis of Variance (ANOVA) was accomplished upon the airlift data grouped by sortie length classification as previously described, total sorties flown, average utilization by flight hours and sorties per month, and by aircraft assigned home base. Total sorties were grouped as follows:

for the C-130E Aircraft (Jun 76 - May 77 data)

Class	
1	less than 126 sorties
2	126 to 175 sorties
3	176 to 250 sorties
4	more than 250 sorties

for the C-141A Aircraft (Jun 76 - May 77 data)

Class	
1	up to 250 sorties
2	250 to 325 sorties
3	326 to 400 sorties
4	more than 400 sorties

The average monthly utilization by flying hours was grouped as follows:

for the C-130E Aircraft (Jun 76 - May 77 data)

Class	
1	up to 40 hours per month
2	40 to 50 hours per month
3	50 to 60 hours per month
4	more than 60 hours per month

for the C-141A Aircraft (Jun 76 - May 77 data)

Class	
1	up to 80 hours per month
2	80 to 95 hours per month
3	95 to 110 hours per month
4	more than 110 hours per month

The average utilization in number of sorties per month was grouped as follows:

for the C-130E Aircraft (Jun 76 - May 77 data)

Class	
1	less than 10 sorties per month
2	10 to 17 sorties per month
3	17 to 24 sorties per month
4	more than 24 sorties per month

for the C-141A Aircraft (Jun 76 - May 77 data)

Class	
1	less than 23 sorties per month
2	23 to 27 sorties per month
3	27 to 32 sorties per month
4	more than 32 sorties per month

The base of assignment was also used as a classification for the ANOVA research. The results of the ANOVA, presented in Tables 24 and 25, illustrate that there is a significant impact upon maintenance requirements caused by each of the factors that were analyzed. There also was significant interaction between many of the variables.

TABLE 24. RESULTS OF ANOVA FOR C-130E AIRCRAFT
(Data from Jun 76 to May 77)

F Value - Sum of squares between treatments divided by sums of squares within treatments
PR>F - Probability of chance F value occurring given no effect of variable(s)
R^2 - Linear correlation coefficient
C.V. - Coefficient of variation

System	Sortie Length F Value	Sortie Length (PR>F)	Total Sorties F Value	Total Sorties (PR>F)	Hrs/Month F Value	Hrs/Month (PR>F)
11 Airframe	9.17	(.0001)	64.76	(.0001)	62.69	(.0001)
12 Fuselage Compartments	6.65	(.0004)	38.44	(.0001)	40.60	(.0001)
13 Landing Gear	45.99	(.0001)	124.05	(.0001)	59.82	(.0001)
14 Flight Controls	1.17	(.3243)	37.36	(.0001)	46.35	(.0001)
22 Engine	11.71	(.0001)	60.91	(.0001)	48.86	(.0001)
24 Aux Power Plant	2.14	(.0980)	32.84	(.0001)	53.06	(.0001)
41 Air Cond	9.04	(.0001)	78.05	(.0001)	72.29	(.0001)
42 Electrical Power Supply	1.72	(.1662)	32.23	(.0001)	49.39	(.0001)
44 Lighting Systems	10.00	(.0001)	47.13	(.0001)	51.03	(.0001)
45 Hydraulic & Pneumatic Sys	8.61	(.0001)	61.71	(.0001)	42.28	(.0001)
46 Fuel Systems	21.98	(.0001)	43.60	(.0001)	29.01	(.0001)
47 Oxygen Supply	7.68	(.0001)	46.39	(.0001)	29.04	(.0001)
49 Misc Utilities	1.08	(.3598)	42.82	(.0001)	67.61	(.0001)
51 Instruments	7.96	(.0001)	36.84	(.0001)	29.84	(.0001)
52 Autopilot	1.38	(.2517)	8.70	(.0001)	6.03	(.0009)
61 Communications	29.21	(.0001)	59.40	(.0001)	32.97	(.0001)
65 IFF	0.65	(.5910)	5.55	(.0016)	6.48	(.0005)
71 Radio Navigation	20.61	(.0001)	29.16	(.0001)	5.42	(.0018)
72 Radar Navigation	30.20	(.0001)	46.44	(.0001)	18.96	(.0001)
Total Maintenance	30.43	(.0001)	154.42	(.0001)	128.84	(.0001)

TABLE 24. RESULTS OF ANOVA FOR C-130E AIRCRAFT (Cont'd)
(Data from Jun 76 to May 77)

System		Sorties/Month F Value	Sorties/Month (PR>F)	Assigned Base F Value	Assigned Base (PR>F)	Model F Value	PR>F	R^2	C.V.
11	Airframe	73.49	(.0001)	11.27	(.0001)	4.96	.0001	.833	29.4
12	Fuselage Compartments	36.48	(.0001)	11.39	(.0001)	4.42	.0001	.817	32.4
13	Landing Gear	118.69	(.0001)	9.98	(.0001)	5.86	.0001	.855	28.2
14	Flight Controls	30.88	(.0001)	7.07	(.0001)	3.64	.0001	.786	38.5
22	Engine	84.20	(.0001)	22.95	(.0001)	5.29	.0001	.842	27.5
24	Aux Power Plant	33.46	(.0001)	17.33	(.0001)	4.79	.0001	.829	34.2
41	Air Cond	89.44	(.0001)	17.36	(.0001)	6.34	.0001	.865	29.0
42	Electrical Power Supply	40.56	(.0001)	15.61	(.0001)	4.05	.0001	.804	37.8
44	Lighting Systems	53.67	(.0001)	7.93	(.0001)	4.90	.0001	.832	33.7
45	Hydraulic & Pneumatic Sys	63.81	(.0001)	16.07	(.0001)	6.83	.0001	.873	29.7
46	Fuel Systems	54.17	(.0001)	8.37	(.0001)	3.10	.0001	.758	39.0
47	Oxygen Supply	53.43	(.0001)	7.35	(.0001)	3.92	.0001	.798	40.9
49	Misc Utilities	54.24	(.0001)	26.70	(.0001)	7.03	.0001	.877	34.1
51	Instruments	48.78	(.0001)	22.88	(.0001)	4.87	.0001	.831	30.1
52	Autopilot	8.79	(.0001)	5.55	(.0001)	1.55	.0132	.610	51.3
61	Communications	74.80	(.0001)	9.52	(.0001)	4.31	.0001	.812	26.2
65	IFF	3.55	(.0171)	2.08	(.0327)	1.47	.0252	.601	94.8
71	Radio Navigation	23.50	(.0001)	2.05	(.0353)	1.74	.0027	.637	37.2
72	Radar Navigation	46.90	(.0001)	11.81	(.0001)	4.06	.0001	.804	26.9
Total Maintenance		175.34	(.0001)	23.22	(.0001)	9.58	.0001	.906	17.4

TABLE 25. RESULTS OF ANOVA FOR C-141A AIRCRAFT
(Data from Jun 76 to May 77)

F Value - Sum of squares between treatments divided by sums of squares within treatments
PR>F - Probability of chance F value occurring given no effect of variable(s)
R^2 - Linear correlation coefficient
C.V. - Coefficient of variation

System		Sortie Length		Total Sorties		Hrs/Month	
		F Value	(PR>F)	F Value	(PR>F)	F Value	(PR>F)
11	Airframe	14.46	(.0001)	21.82	(.0001)	18.81	(.0001)
12	Fuselage Compartments	10.63	(.0001)	13.39	(.0001)	7.36	(.0002)
13	Landing Gear	11.13	(.0001)	19.02	(.0001)	16.19	(.0001)
14	Flight Controls	8.66	(.0001)	18.12	(.0001)	16.20	(.0001)
23	Engine	17.30	(.0001)	24.76	(.0001)	14.00	(.0001)
24	Aux Power Plant	8.22	(.0001)	5.40	(.0017)	2.44	(.0662)
41	Air Cond	12.44	(.0001)	14.26	(.0001)	6.62	(.0004)
42	Electrical Power Supply	7.55	(.0001)	11.26	(.0001)	7.83	(.0001)
44	Lighting Systems	11.26	(.0001)	9.39	(.0001)	3.61	(.0151)
45	Hydraulic & Pneumatic Sys	18.19	(.0001)	14.86	(.0001)	6.23	(.0006)
46	Fuel Systems	2.74	(.0450)	16.13	(.0001)	14.43	(.0001)
47	Oxygen Supply	8.31	(.0001)	9.73	(.0001)	4.39	(.0058)
49	Misc Utilities	25.14	(.0001)	23.13	(.0001)	9.36	(.0001)
51	Instruments	8.20	(.0001)	11.49	(.0001)	6.51	(.0005)
52	Autopilot	3.28	(.0230)	11.98	(.0001)	15.08	(.0001)
61	Communications	2.60	(.0539)	17.39	(.0001)	10.25	(.0001)
65	IFF	1.46	(.2266)	9.00	(.0001)	7.03	(.0003)
71	Radio Navigation	4.14	(.0078)	17.23	(.0001)	12.03	(.0001)
72	Radar Navigation	10.76	(.0001)	12.04	(.0001)	7.11	(.0002)
Total Maintenance		23.61	(.0001)	37.19	(.0001)	23.91	(.0001)

TABLE 25. RESULTS OF ANOVA FOR C-141A AIRCRAFT (Cont'd)
(Data from Jun 76 to May 77)

System		Sorties/Month F Value	Sorties/Month (PR>F)	Assigned Base F Value	Assigned Base (PR>F)	Model F Value	PR>F	R^2	C.V.
11	Airframe	31.71	(.0001)	30.51	(.0001)	3.07	.0001	.694	26.2
12	Fuselage Compartments	17.13	(.0001)	30.48	(.0001)	2.73	.0001	.668	33.9
13	Landing Gear	25.58	(.0001)	32.08	(.0001)	3.18	.0001	.701	28.1
14	Flight Controls	21.92	(.0001)	20.78	(.0001)	3.08	.0001	.695	30.2
23	Engine	28.81	(.0001)	22.58	(.0001)	2.95	.0001	.685	25.4
24	Aux Power Plant	7.37	(.0002)	15.0	(.0001)	1.72	.0021	.559	50.1
41	Air Cond	14.38	(.0001)	31.78	(.0001)	3.05	.0001	.692	29.8
42	Electrical Power Supply	8.73	(.0001)	32.44	(.0001)	2.91	.0001	.682	31.2
44	Lighting Systems	12.04	(.0001)	46.66	(.0001)	3.14	.0001	.699	37.9
45	Hydraulic & Pneumatic Sys	19.35	(.0001)	53.38	(.0001)	3.50	.0001	.721	35.9
46	Fuel Systems	18.18	(.0001)	3.25	(.0140)	2.47	.0001	.646	28.7
47	Oxygen Supply	8.91	(.0001)	27.59	(.0001)	2.49	.0001	.648	38.7
49	Misc Utilities	31.36	(.0001)	33.83	(.0001)	2.86	.0001	.679	33.1
51	Instruments	11.87	(.0001)	12.06	(.0001)	1.88	.0004	.581	25.9
52	Autopilot	15.83	(.0001)	6.81	(.0001)	1.99	.0001	.596	30.3
61	Communications	14.32	(.0001)	10.01	(.0001)	1.67	.0033	.552	23.6
65	IFF	5.15	(.0023)	5.79	(.0003)	2.35	.0001	.635	64.5
71	Radio Navigation	13.00	(.0001)	6.47	(.0001)	2.16	.0001	.615	28.0
72	Radar Navigation	15.70	(.0001)	24.52	(.0001)	2.49	.0001	.648	26.1
Total Maintenance		44.58	(.0001)	45.68	(.0001)	4.39	.0001	.764	19.2

PROBLEMS AND QUALIFICATIONS

DATA PROBLEMS

In reducing the data a number of problems were encountered with the usage of the MDC system. Not only was there often missing data, but there were apparent inconsistencies in how some items were documented. Many maintenance actions may not have been documented at all, some appear to have been grouped differently when reported from various bases, and some may have been in error. In any case a review of the MDC system has been initiated and a more accurate method of obtaining data will undoubtedly be of assistance in future research.

DATA NOT AVAILABLE

If, in the future, failure data could be documented according to the time within the sortie the failure occurred, then a more accurate analysis of flight phase failure rate might be undertaken.

Differences between ages of the aircraft, number of landings and crew techniques were not available for this study. However, it might be noted that each of the bases is assigned aircraft of varying ages, and all crews are trained at a common location using a standardized methodology and that crew members and maintenance personnel are often reassigned to other bases having the same type aircraft.

NUMBER OF AIRCRAFT TYPES AND DATA TIME PERIODS

Another limiting factor is the time and number of aircraft types studied. Data for different periods of time might be considered as well as other aircraft types in order that a more complete study might be undertaken in the future.

CONCLUSIONS AND RECOMMENDATION

USAGE OF RESULTS

From the correlations (Tables 18 and 19) and linear regression results (Tables 2, and 6 through 17) it can be concluded that there is, to varying degrees, a cyclic and a flight hour failure factor involved in aircraft reliability. In order to use the information gained from this study the engineer need only compute the percent of maintenance that is cyclic or sortie related (PSR) for each sortie length in question. See Figure 3.

Since the processed MDC data gives the engineer the mean number of sorties between maintenance actions (MSBMA1) for the comparison aircraft with a known sortie length (S_1), the average cyclic or sortie related failure constant can be computed as follows:

$$MAPS = \left(\frac{1}{MSBMA_1}\right)(PSR_1) = \text{a constant}$$

where MAPS = maintenance actions per sortie associated with the cycle only $\left(\frac{1}{MSBMA_1}\right)$ = average maintenance actions per sortie of length S_1 PSR_1 = percent of maintenance that is sortie related for sortie length S_1 (from Tables 26 through 29 or as computed by the engineer).

So we see that the mean number of sorties between maintenance actions for the developmental aircraft ($MSBMA_2$) can be calculated from the known information

$$\text{now } MAPS = \left(\frac{1}{MSBMA_2}\right)(PSR_2) = \text{known (from above)}$$

so solving the equation for $MSBMA_2$

$$\text{gives } MSBMA_2 = \frac{PSR_2}{MAPS} = MSBMA_1 \left(\frac{PSR_2}{PSR_1}\right)$$

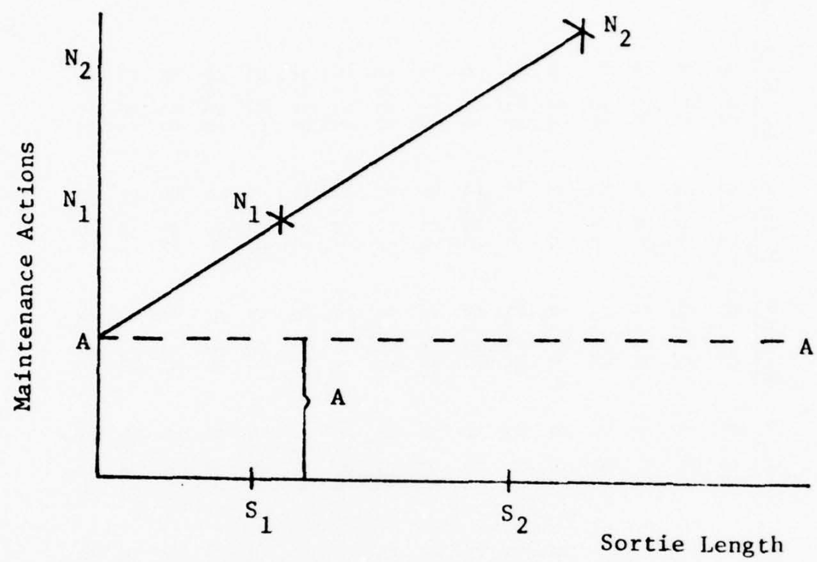


Figure 3. Average Maintenance Actions vs Sortie Lengths

N_i = total average maintenance actions per sortie length i

i = 1, 2, 3, . . .

A = average number of failures per cycle only (regression line intercept)

percent sortie related (PSR) = $\frac{A}{N_i}$

TABLE 26. PERCENT OF MAINTENANCE ACTIONS THAT ARE SORTIE RELATED
(by sortie length using B-52 regressed data only)

System	Sortie Length 1 Hr	2 Hrs	3 Hrs	4 Hrs	5 Hrs	6 Hrs	7 Hrs	8 Hrs	9 Hrs	10 Hrs	11 Hrs	12 Hrs
11 Airframe	77.4	63.2	53.4	46.2	40.7	36.4	32.9	30.0	27.6	25.6	23.8	22.2
12 Fuselage	89.3	80.6	73.5	67.5	62.5	58.1	54.3	51.0	48.1	45.4	43.1	41.0
13 Landing Gear	98.5	97.1	95.7	94.3	93.0	91.7	90.4	89.2	88.0	86.9	85.8	84.7
14 Flt. Controls	89.7	81.4	74.5	68.6	63.6	59.3	55.6	52.2	49.3	46.7	44.3	42.2
23 Engines	69.8	53.6	43.5	36.6	31.6	27.8	24.8	22.4	20.4	18.8	17.4	16.1
41 Air Cond.	90.1	82.0	75.3	69.5	64.6	60.3	56.6	53.3	50.3	47.7	45.3	43.2
42 Elec. Pwr.	90.8	83.2	76.8	71.3	66.5	62.3	58.6	55.4	52.5	49.8	47.4	45.3
44 Lighting	57.0	39.8	30.6	24.9	20.9	18.1	15.9	14.2	12.8	11.7	10.7	9.9
45 Hyd. Pwr.	87.1	77.2	69.3	62.9	57.5	53.0	49.2	45.8	42.3	40.4	38.1	36.1
46 Fuel	70.7	54.7	44.6	37.7	32.6	28.7	25.7	23.2	21.2	19.5	18.0	16.8
47 Oxygen	92.3	85.7	79.9	74.9	70.5	66.6	63.1	59.9	57.0	54.4	52.1	49.9
51 Inst.	97.3	94.8	92.4	90.1	88.0	85.9	83.9	82.0	80.2	78.5	76.9	75.3
52 Autopilot	98.8	97.6	96.4	95.3	94.2	93.1	92.0	91.0	90.0	89.0	88.0	87.1
63 UHF Comm.	97.9	95.9	94.0	92.1	90.4	88.6	87.0	85.4	83.9	82.4	81.0	79.6
74 Fire Cont.	69.9	53.7	43.6	36.7	31.7	27.9	24.9	22.5	20.5	18.8	17.4	16.2
VHF + Interphone	97.0	94.1	91.5	88.9	86.5	84.3	82.1	80.1	78.1	76.3	74.5	72.8

TABLE 27. PERCENT OF MAINTENANCE ACTIONS THAT ARE SORTIE RELATED
(by sortie length using civilian regressed data only)

System	Sortie Length 1 Hr	2 Hrs	3 Hrs	4 Hrs	5 Hrs	6 Hrs	7 Hrs	8 Hrs	9 Hrs	10 Hrs	11 Hrs	12 Hrs
11 Airframe	8.6	4.5	3.0	2.3	1.9	1.5	1.3	1.2	1.0	.9	.85	.8
12 Fuselage	0	0	0	0	0	0	0	0	0	0	0	0
13 Landing Gear	56.0	38.9	29.8	24.1	20.3	17.5	15.4	13.7	12.4	11.3	10.4	9.6
14 Flt. Controls	9.5	5.0	3.4	2.6	2.1	1.7	1.5	1.3	1.2	1.0	.9	.87
23 Engines	19.1	9.6	6.4	4.8	3.9	3.2	2.8	2.4	2.2	1.9	1.8	1.6
41 Air Cond.	36.7	22.5	16.2	12.7	10.4	8.8	7.7	6.8	6.1	5.5	5.0	4.6
42 Elec. Pwr.	38.7	24.0	17.4	13.6	11.2	9.5	8.3	7.3	6.5	5.9	5.4	5.0
44 Lighting	29.9	17.6	12.5	9.6	7.9	6.6	5.8	5.1	4.5	4.1	3.7	3.4
45 Hyd. Pwr.	24.0	13.7	9.5	7.3	6.0	5.0	4.3	3.8	3.4	3.1	2.8	2.6
46 Fuel	17.0	9.3	6.4	4.9	3.9	3.3	2.8	2.5	2.2	2.0	1.8	1.7
47 Oxygen	66.7	50.0	40.0	33.3	28.6	25.0	22.2	20.0	18.2	16.7	15.4	14.3
51 Inst.	36.1	22.1	15.9	12.4	10.2	8.6	7.5	6.6	5.9	5.4	4.9	4.5
52 Autopilot	49.0	32.5	24.3	19.4	16.1	13.8	12.1	10.7	9.7	8.8	8.0	7.4
63 UHF Comm.	32.9	19.7	14.0	10.9	8.9	7.5	6.5	5.8	5.2	4.7	4.3	3.9
74 Fire Cont.	49.0	32.5	24.3	19.4	16.1	13.8	12.1	10.7	9.7	8.8	8.0	7.4
UHF + Interphone	32.9	19.7	14.0	10.9	8.9	7.5	6.5	5.8	5.2	4.7	4.3	3.9

TABLE 28. PERCENT OF MAINTENANCE ACTIONS THAT ARE SORTIE (CYCLIC) RELATED
(by sortie length using C-130E regressed data)

System		Sortie Length 1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	7 hr	8 hr	9 hr	10 hr
11	Airframe	76.5	62.0	52.1	44.9	39.5	35.2	31.8	29.0	26.6	24.6
12	Fuselage Compartments	85.9	75.3	67.1	60.4	55.0	50.4	46.6	43.3	40.4	37.9
13	Landing Gear	3.1	1.6	1.05	.79	.63	.53	.45	.40	.35	.32
14	Flight Controls	91.0	83.5	77.1	71.7	66.9	62.8	59.1	55.8	53.0	50.3
22	Engine	74.1	58.9	48.8	41.7	36.4	32.3	29.0	26.3	24.1	22.2
24	Aux Power Plant	99.8	99.4	99.1	98.8	98.5	98.2	97.9	97.7	97.4	97.1
41	Air Cond	78.6	64.8	55.1	48.0	42.4	38.0	34.5	31.5	29.0	26.9
42	Electrical Power Supply	91.0	83.5	77.2	71.7	67.0	62.8	59.2	55.9	53.0	50.4
44	Lighting Systems	82.4	70.1	61.0	54.0	48.4	43.8	40.1	36.9	34.2	31.9
45	Hydraulic & Pneumatic Sys	76.9	62.5	52.6	45.5	40.0	35.7	32.3	29.4	27.0	25.0
46	Fuel Systems	39.7	24.8	18.0	14.1	11.6	9.9	8.6	7.6	6.8	6.2
47	Oxygen Supply	60.0	42.9	33.3	27.3	23.1	20.0	17.6	15.8	14.3	13.0
49	Misc Utilities	90.8	83.1	76.6	71.1	66.3	62.1	58.4	55.1	52.2	49.6
51	Instruments	76.6	62.0	52.1	45.0	39.5	35.3	31.8	29.0	26.6	24.6
52	Autopilot	83.9	72.3	63.5	56.6	51.1	46.5	42.7	39.5	36.7	34.3
61	Communications	50.0	33.3	25.0	20.0	16.6	14.3	12.5	11.1	10.0	9.1
65	IFF	82.4	70.0	60.9	53.8	48.3	43.8	40.0	36.8	34.1	31.8
71	Radio Navigation	33.3	20.0	14.3	11.1	9.1	7.7	6.6	5.9	5.3	4.8
72	Radar Navigation	54.7	37.7	28.7	23.2	19.5	16.8	14.7	13.1	11.8	10.8

TABLE 29. PERCENT OF MAINTENANCE ACTIONS THAT ARE SORTIE (CYCLIC) RELATED
(By Sortie Length Using C-141A Regressed Data)

System		Sortie Length									
		1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	7 hr	8 hr	9 hr	10 hr
11	Airframe	0	0	0	0	0	0	0	0	0	0
12	Fuselage Compartments	0	0	0	0	0	0	0	0	0	0
13	Landing Gear	0	0	0	0	0	0	0	0	0	0
14	Flight Controls	0	0	0	0	0	0	0	0	0	0
23	Engine	0	0	0	0	0	0	0	0	0	0
24	Aux Power Plant	0	0	0	0	0	0	0	0	0	0
41	Air Cond	0	0	0	0	0	0	0	0	0	0
42	Electrical Power Supply	46.2	30.0	22.2	17.6	14.6	12.5	10.9	9.7	8.7	7.9
44	Lighting Systems	0	0	0	0	0	0	0	0	0	0
45	Hydraulic & Pneumatic Sys	0	0	0	0	0	0	0	0	0	0
46	Fuel Systems	92.1	85.3	79.5	74.4	69.9	66.0	62.4	59.2	56.4	53.8
47	Oxygen Supply	4.8	2.4	1.6	1.2	1.0	0.8	0.7	0.6	0.6	0.5
49	Misc Utilities	0	0	0	0	0	0	0	0	0	0
51	Instruments	44.7	28.8	21.2	16.8	13.9	11.9	10.3	9.2	8.2	7.5
52	Autopilot	76.2	74.4	60.4	50.8	43.8	38.6	34.4	31.1	28.3	26.0
61	Communications	81.5	68.8	59.5	52.4	46.8	42.3	38.6	35.5	32.8	30.6
65	IFF	54.3	37.3	28.4	22.9	19.2	16.5	14.5	12.9	11.7	10.6
71	Radio Navigation	77.8	63.6	53.8	46.7	41.2	36.8	33.3	30.4	28.0	25.9
72	Radar Navigation	46.7	30.4	22.6	17.9	14.4	12.7	11.1	9.9	8.9	8.0

In this manner the engineer can take data from an operational aircraft flying a known average sortie length, and adjust the mean number of sorties between maintenance actions, or failure rate, to account for a planned different sortie length when making maintenance forecasts for a developmental aircraft.

Another method that can be used to forecast the failure rate, when using the data from this report as the comparison basis, is to use the intercept of the appropriate aircraft system regressed data added to the slope of this data times the number of hours in the expected sortie length of the developmental aircraft.

This second technique can only be used when using the actual data within this study whereas the first technique can be used, when we assume the percent sortie related (PSR) the same for other data sources as for one of the aircraft in this study, for many different comparison studies.

For instance, in forecasting maintenance requirements for a new Short Takeoff and Landing (STOL) aircraft, the Advanced Medium STOL Transport (AMST) many of the parts are the same or similar to those of the C-141A and C-130E aircraft. However, the planned sortie length for this new aircraft is about one hour. Thus either technique described above can be utilized in this case.

Some other parts of the developmental AMST are more like those of the C-5A. And so, if we make the bold assumption that maintenance in the relative areas of the C-5A are equally sortie related (has the same

PSR) as those of the C-141A, we can use the first technique utilizing the PSRs from the C-141A and the MDC data from the C-5A.

Thus there are several situations which might occur. To illustrate by using some calculations of the AMST forecasted maintenance failure rate:

Situation 1: The electrical system (System 42) of the AMST is quite similar to that of the C-141A and so no reliability adjustment is necessary. However, the average sortie length associated with the C-141A data is 4 hours. The average planned sortie length of the AMST is 1 hour. The mean sorties between maintenance actions ($MSBMA_1$) for the C-141A is 18. So the mean sorties between maintenance actions ($MSBMA_2$) for the AMST can be calculated as follows:

$$MSBMA_2 = \frac{PSR_2}{PSR_1} \; MSBMA_1$$

$MSBMA_1$ = 18 from MDC data for C-141A

PSR_2 = 46.2 from Table 29 sortie length 1 hour

PSR_1 = 17.6 from Table 29 sortie length 4 hours

thus

$$MSBMA_2 = \frac{46.2}{17.2} \; (18) = 48$$

Situation 2: The Pitch Trim (WUC 14D) from the AMST is similar to that of the C-141A and so no adjustment is necessary to account for reliability. From Table 29 we see that the flight controls are not sortie related (PSR = 0) and so we go to Table 11 to find that the average number of failures per flight hour is .064. From the second

computational technique and recalling that the planned sortie length for the AMST is 1 hour,

$$MSBMA_2 = \frac{1}{\text{maintenance actions per sortie}} = \frac{1}{.064} \simeq 16$$

Situation 3: The Fuel Controls (System 46J) of the AMST are to be like those of the C-5A. We must now assume the percent sortie related (PSR) for maintenance actions on the C-5A to be the same as those of the C-141A. Then from the first technique the $MSBMA_1$ for the C-5A is 45 from MDC data. The C-5A flew an average sortie length of 5 hours and the AMST is planned for 1 hour sorties. Then by utilizing Table 29,

$$MSBMA_2 = \frac{PSR_2}{PSR_1} \ (MSBMA_1) = \frac{92.1}{69.9} \ (45) \simeq 59.$$

RECOMMENDATIONS FOR DATA COLLECTION AND FURTHER STUDY

Although further study into the factors that affect maintenance requirements is recommended, the use of the data for the most similar aircraft, as presented in this report, can be of benefit to the simulation engineer.

As emphasized earlier, there is a need for accurate maintenance data that includes the time into the sortie that each failure occurs. This data need be collected by aircraft serial number and include all relevant factors such as data, phase of flight, airframe age, age of failed part, utilization, historic mission summary, weather, where maintenance work was accomplished, etc. With a more complete data set a factor analysis may prove quite useful in future failure forecasting.

In the meantime it is recommended that MDC data be analyzed, using the techniques developed in this study, for other time periods and also for other aircraft, to further refine the results of this study.

APPENDIX A

Data Reducti(n Technique
for C-130E and C-141 Aircraft

The C-130E and C-141A data arrived from AFLC on sixteen 9-track tapes which listed the maintenance data in cronological order of all maintenance actions performed by type aircraft. First, these tapes were converted to 7-track tapes to speed processing on the CDC-6600 computer system.

Next, the relevant data was extracted and grouped by four digit aircraft tail numbers (last four digits of aircraft serial number). Then the data was grouped by aircraft system for each individual aircraft. Finally, the data was punched on IBM cards to be used in the Statistical Analysis System (SAS) to analyze the failure data. See Figure A-1. Computer programs and collection notes follow.

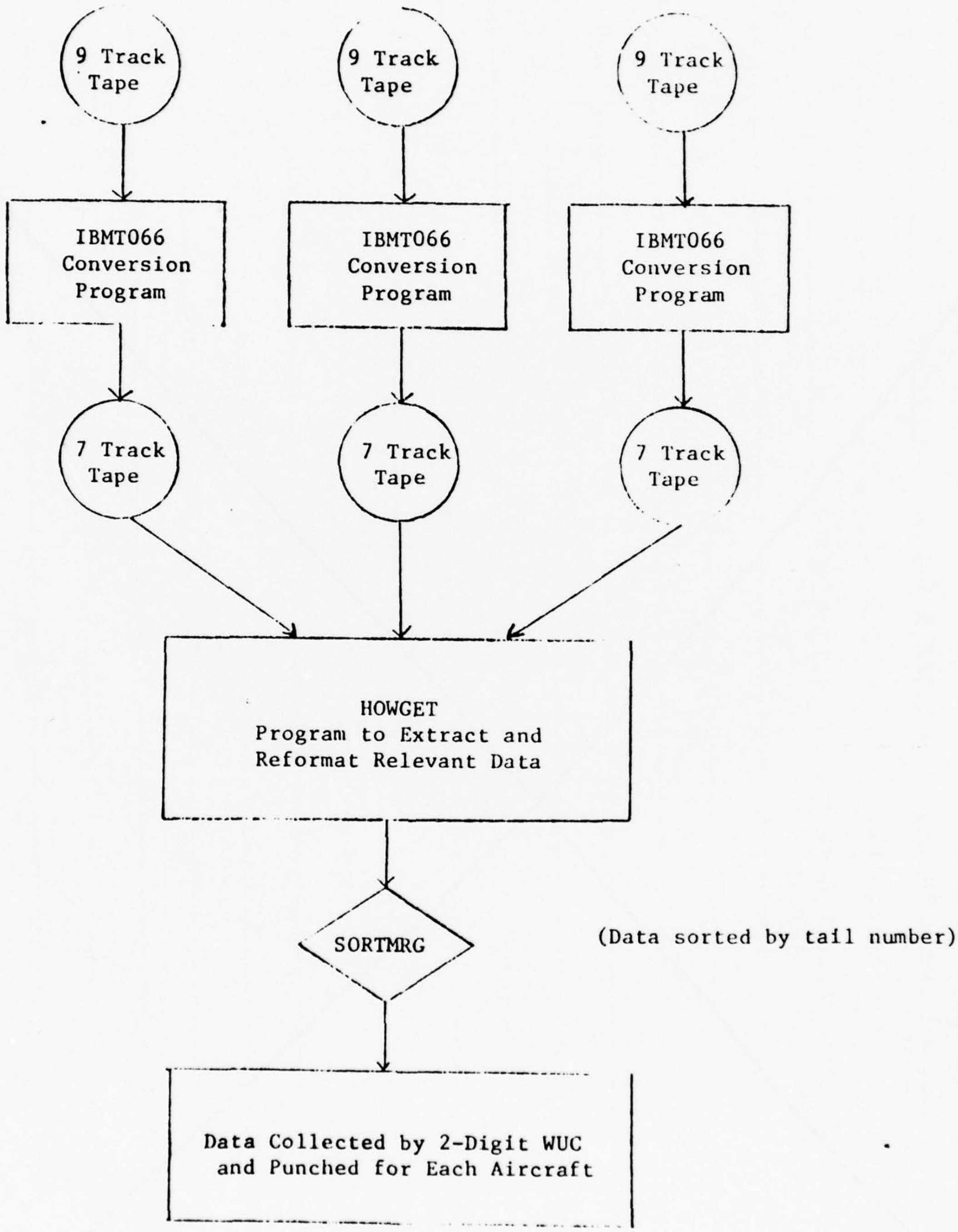


Figure A-1. Data Collection Method

```
ZMAJ,SICSA,T1500,IO1500,CM50000,MT2.  E740052,BEGIN,56531  9TK-7TK X TO L STEP I
VSN,TAPE8=X00867=01P007.
PAUSE OPERATOR...DROP JOB WHEN TAPE8 RUNS OFF REEL...
REQUEST,TAPE8,S,NORING.
PAUSE. TAPE7 IS A MULTI-REEL FILE.
VSN,TAPE7=L06118/L06119.
LABEL,TAPE7,W,D=HY,RING,L=AFM6691TOMMMFORM4.    E740052
ATTACH,IBMT066,POWELLIBM,CY=1,MR=1.
IBMT066.
RETURN,TAPE8,TAPE7.
**
C1418
```

```
Z1AJ,STCSA,T1500,IO1500,CM50000,MT2.  E740052,BEGIN,56531  9TK-7TK X TO L STEP I
VSN,TAPE8=X00867=01B007.
PAUSE.OPERATOR...DROP JOB WHEN TAPE8 RUNS OFF REEL...
REQUEST,TAPE8,S,NORING.
PAUSE. TAPE7 IS A MULTI-REEL FILE.
VSN,TAPE7=L06118/L06119.
LABEL,TAPE7,W,D=HY,RING,L=AFM66R1TOMMMFORM4.   E740052
ATTACH,IBMTO66,HOWELLIBM,CY=1,MR=1.
IBMTO66.
RETURN,TAPE8,TAPE7.
**
C141A
```

```
Z1ZA,T20,I050,MT1,STCSA,DBS01.  E740052,BEGIN,56531
ATTACH,PROG,IBMHOWELL,CY=33,SN=ASDEN,MR=1.
LABEL,TAPE8,R,D=HY,L=C141AHOWELLDATA,VSN=L03810,NORING.
LGO,PL=4000.
RETURN,PROG,TAPE8.
**
```

```
ZICA,STCSA,T350,IO950,CM65000,MT2,DBS00.  E740052,BEGIN,56531  C141ACREATE III
LIMIT,4000.
VSN,TAPE24=L06119/L06120.
LABEL,TAPE24,R,D=HY,NORING,L=C141ABYJCNOCTMAY.    E740052
COPYCF,TAPE24,TAPE1.
REWIND,TAPE1.
SORTMRG(6C)
REWIND,TAPE1.
REWIND,TAPE4.
ATTACH,ADJUST,ADJUST,ID=E740052,CY=2.
LDSET,PRESET=ZERO.
ADJUST.
RETURN,ADJUST.
REWIND,TAPE1,TAPE2.
FILE,TAPE1,FO=SQ,BT=C,RT=Z,FL=150.
ATTACH,COMBINE,COMBINE,ID=E740052,CY=2.
LDSET,PRESET=ZERO.
COMBINE.
RETURN,COMBINE.
REWIND(TAPE1,TAPE2)
FILE,TAPE2,FO=SQ,BT=C,RT=Z,FL=33.
LDSET(FILES=TAPE1/TAPE2)
SORTMRG(6C)
REWIND(TAPE1,TAPE2)
ATTACH,COLLECT,COLLECT,ID=E740052,CY=1.
LDSET,PRESET=ZERO.COLLECT.
RETURN,COLLECT.
REWIND(TAPE1,TAPE2)
FILE,TAPE2,FO=SQ,BT=C,RT=Z,FL=41.
LDSET(FILES=TAPE1/TAPE2)
SORTMRG(6C)
REWIND(TAPE1,TAPE2)
ATTACH,REPORT,REPORT,ID=E740052,CY=2.
LDSET,PRESET=ZERO.
REPORT.
RETURN,REPORT.
REWIND,TAPE8,TAPE9,TAPE10,TAPE12.
FILE,TAPE12,FO=SQ,BT=C,RT=Z,FL=150.
FILE,TAPE3,FO=SQ,BT=C,RT=Z,FL=33.
LDSET(FILES=TAPE3/TAPE12)
SORTMRG(6C)
REWIND,TAPE3,TAPE12.
```

```
ATTACH,TAPE17,DATABNK2,ID=E740052,CY=1.
LABEL,TAPE19,W,D=HY,L=C141AHOWELLDATA,VSN=LO3810,RING.
ATTACH,WUCMG,WUCMG,ID=E740052,CY=1.
LDSET,PRESET=ZERO.
WUCMG.
RETURN,WUCMG.
ATTACH,THRELVL,THRELVL,ID=E740052,CY=1.
LDSET,PRESET=ZERO.
THRELVL.
RETURN,THRELVL.
RETURN,TAPE8,TAPE9,TAPE10.
COPYCF,TAPE24,TAPE1.
REWIND,TAPE1.
SORTMRG(6C)
REWIND,TAPE1.
REWIND,TAPE4.
ATTACH,ADJUST,ADJUST,ID=E740052,CY=2.
LDSET,PRESET=ZERO.
ADJUST.
RETURN,ADJUST.
REWIND,TAPE1,TAPE2.
FILE,TAPE1,FO=SQ,BT=C,RT=Z,FL=150.
ATTACH,COMBINE,COMBINE,ID=E740052,CY=2.
LDSET,PRESET=ZERO.
COMBINE.
RETURN,COMBINE.
REWIND(TAPE1,TAPE2)
FILE,TAPE2,FO=SQ,BT=C,RT=Z,FL=33.
LDSET(FILES=TAPE1/TAPE2)
SORTMRG(6C)
REWIND(TAPE1,TAPE2)
ATTACH,COLLECT,COLLECT,ID=E740052,CY=1.
LDSET,PRESET=ZERO.
COLLECT.
RETURN,COLLECT.
REWIND(TAPE1,TAPE2)
FILE,TAPE2,FO=SQ,BT=C,RT=Z,FL=41.
LDSET(FILES=TAPE1/TAPE2)
SORTMRG(6C)
REWIND(TAPE1,TAPE2)
ATTACH,REPORT,REPORT,ID=E740052,CY=2.
LDSET,PRESET=ZERO.
REPORT.
RETURN,REPORT.
```

```
REWIND,TAPE8,TAPE9,TAPE10,TAPE12.
FILE,TAPE12,FO=SQ,BT=C,RT=Z,FL=150.
FILE,TAPE3,FO=SQ,BT=C,RT=Z,FL=33.
LDSET(FILES=TAPE3/TAPE12)
SORTMRG(6C)
REWIND,TAPE3,TAPE12.
REWIND,TAPE17.
ATTACH,WUCMG,WUCMG,ID=E740052,CY=1.
LDSET,PRESET=ZERO.
WUCMG.
RETURN,WUCMG.
ATTACH,THRELVL,THRELVL,ID=E740052,CY=1.
LDSET,PRESET=ZERO.
THRELVL.
RETURN,THRELVL.
RETURN,TAPE8,TAPE9,TAPE10.
COPYCF,TAPE24,TAPE1.
REWIND,TAPE1.
SORTMRG(6C)
REWIND,TAPE1.
REWIND,TAPE4.
ATTACH,ADJUST,ADJUST,ID=E740052,CY=2.
LDSET,PRESET=ZERO.
ADJUST.
RETURN,ADJUST.
REWIND,TAPE1,TAPE2.
FILE,TAPE1,FO=SQ,BT=C,RT=Z,FL=150.
ATTACH,COMBINE,COMBINE,ID=E740052,CY=2.
LDSET,PRESET=ZERO.
COMBINE.
RETURN,COMBINE.
REWIND(TAPE1,TAPE2)
FILE,TAPE2,FO=SQ,BT=C,RT=Z,FL=33.
LDSET(FILES=TAPE1/TAPE2)
SORTMRG(6C)
REWIND(TAPE1,TAPE2)
ATTACH,COLLECT,COLLECT,ID=E740052,,CY=1.
LDSET,PRESET=ZERO.
COLLECT.
RETURN,COLLECT.
REWIND(TAPE1,TAPE2)
FILE,TAPE2,FO=SQ,BT=C,RT=Z,FL=41.
LDSET(FILES=TAPE1/TAPE2)
SORTMRG(6C)
REWIND(TAPE1,TAPE2)
ATTACH,REPORT,REPORT,ID=E740052,CY=2.
```

```
LDSET,PRESET=ZERO.
REPORT.
RETURN,REPORT.
REWIND,TAPE8,TAPE9,TAPE10,TAPE12.
FILE,TAPE12,FO=SQ,BT=C,RT=Z,FL=150.
FILE,TAPE3,FO=SQ,BT=C,RT=Z,FL=33.
LDSET(FILES=TAPE3/TAPE12)
SORTMRG(6C)
REWIND,TAPE3,TAPE12.
REWIND,TAPE17.
ATTACH,WUCMG,WUCMG,ID=E740052,CY=1.
LDSET,PRESET=ZERO.
WUCMG.
RETURN,WUCMG.
ATTACH,THRELVL,THRELVL,ID=E740052,CY=1.
LDSET,PRESET=ZERO.
THRELVL.
RETURN,THRELVL.
RETURN,TAPE8,TAPE9,TAPE10.
COPYCF,TAPE24,TAPE1.
REWIND,TAPE1.
SORTMRG(6C)
REWIND,TAPE1.
REWIND,TAPE4.
ATTACH,ADJUST,ADJUST,ID=E740052,CY=2.
LDSET,PRESET=ZERO.
ADJUST.
RETURN,ADJUST.
REWIND,TAPE1,TAPE2.
FILE,TAPE1,FO=SQ,BT=C,RT=Z,FL=150.
ATTACH,COMBINE,COMBINE,ID=E740052,CY=2.
LDSET,PRESET=ZERO.
COMBINE.
RETURN,COMBINE.
REWIND(TAPE1,TAPE2)
FILE,TAPE2,FO=SQ,BT=C,RT=Z,FL=33.
LDSET(FILES=TAPE1/TAPE2)
SORTMRG(6C)
REWIND(TAPE1,TAPE2)
ATTACH,COLLECT,COLLECT,ID=E740052,CY=1.
LDSET,PRESET=ZERO.
COLLECT.
RETURN,COLLECT.
REWIND(TAPE1,TAPE2)
```

```
FILE,TAPE2,FO=SQ,BT=C,RT=Z,FL=41.
LDSET(FILES=TAPE1/TAPE2)
SORTMRG(6C)
REWIND(TAPE1,TAPE2)
ATTACH,REPORT,REPORT,ID=E740052,CY=2.
LDSET,PRESET=ZERO.
REPORT.
RETURN,REPORT.
REWIND,TAPE8,TAPE9,TAPE10,TAPE12.
FILE,TAPE12,FO=SQ,BT=C,RT=Z,FL=150.
FILE,TAPE3,FO=SQ,BT=C,RT=Z,FL=33.
LDSET(FILES=TAPE3/TAPE12)
SORTMRG(6C)
REWIND,TAPE3,TAPE12.
REWIND,TAPE17.
ATTACH,WUCMG,WUCMG,ID=E740052,CY=1.
LDSET,PRESET=ZERO.
WUCMG.
RETURN,WUCMG.
ATTACH,THRELVL,THRELVL,ID=E740052,CY=1.
LDSET,PRESET=ZERO.
THRELVL.
RETURN,THRELVL.
RETURN,TAPE8,TAPE9,TAPE10.
RETURN,TAPE19.
TRANSF(Z1ZA)
**
SORT(1,1,45,,4)
FILE(TAPE1,S,D,,R,N)
FILE(TAPE4,O,D,,R,N)
SEQ(37,ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 )
KEY(A,C,1,29)
RECORD(I,U,45)
END
**
  800  800  800
1AFSCDUMMYAFSC ASSIGNED TO RUN
**
SORT(1,1,33,,4)
FILE(TAPE1,S,D,,R,N)
FILE(TAPE2,O,D,,R,N)
SEQ(37,ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 )
KEY(A,C,1,17)
RECORD(I,U,33)
END
**
```

```
SORT(1,1,41,,4)
FILE(TAPE1,S,D,,R,N)
FILE(TAPE2,O,D,,R,N)
SEQ(63 ,ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789+-*/()$= ,.#{}%"_!&'?<>¬\^;)
KEY(A,C,1,15)
RECORD(I,U,41)
END
**
SORT(1,1,33,,4)
FILE(TAPE12,S,D,,R,N)
FILE(TAPE3,O,D,,R,N)
SEQ(63 ,ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789+-*/()$= ,.#{}%"_!&'?<>¬\^;)
KEY(A,C,1,5)
RECORD(I,U,33)
END
**
C141A
**
SORT(1,1,45,,4)
FILE(TAPE1,S,D,,R,N)
FILE(TAPE4,O,D,,R,N)
SEQ(37,ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 )
KEY(A,C,1,29)
RECORD(I,U,45)
END
**
  800  800  800
1AFSCDUMMYAFSC ASSIGNED TO RUN
**
SORT(1,1,33,,4)
FILE(TAPE1,S,D,,R,N)
FILE(TAPE2,O,D,,R,N)
SEQ(37,ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 )
KEY(A,C,1,17)
RECORD(I,U,33)
END
**
SORT(1,1,41,,4)
FILE(TAPE1,S,D,,R,N)
FILE(TAPE2,O,D,,R,N)
SEQ(63 ,ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789+-*/()$= ,.#{}%"_!&'?<>¬\^;)
KEY(A,C,1,15)
RECORD(I,U,41)
END
**
```

```
SORT(1,1,33,,4)
FILE(TAPE12,S,D,,R,N)
FILE(TAPE3,O,D,,R,N)
SEQ(63 ,ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789+-*/()$= ,.#{}%"_!&'?<>@\^:)
KEY(A,C,1,5)
RECORD(I,U,33)
END
**
C141A
**
SORT(1,1,45,,4)
FILE(TAPE1,S,D,,R,N)
FILE(TAPE4,O,D,,R,N)
SEQ(37,ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 )
KEY(A,C,1,29)
RECORD(I,U,45)
END
**
  800  800  800
1AFSCDUMMYAFSC ASSIGNED TO RUN
**
SORT(1,1,33,,4)
FILE(TAPE1,S,D,,R,N)
FILE(TAPE2,O,D,,R,N)
SEQ(37,ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 )
KEY(A,C,1,17)
RECORD(I,U,33)
END
**
SORT(1,1,41,,4)
FILE(TAPE1,S,D,,R,N)
FILE(TAPE2,O,D,,R,N)
SEQ(63 ,ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789+-*/()$= ,.#{}%"_!&'?<>@\^:)
KEY(A,C,1,15)
RECORD(I,U,41)
END
**
SORT(1,1,33,,4)
FILE(TAPE12,S,D,,R,N)
FILE(TAPE3,O,D,,R,N)
SEQ(63 ,ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789+-*/()$= ,.#{}%"_!&'?<>@\^:)
KEY(A,C,1,5)
RECORD(I,U,33)
END
**
```

C130E

20F ES D056E 0180 U 001 AC130E 76 JUN-76 SEP 77172 SP ASD/ENESA WP AFB 7-2701 Z AZ74 OCS 3 7080	X03906 ↓ L04548/L04135
20F ES D056E 0180 U 002 AC130E 76 JUN-76 SEP 77172 SP ASD/ENESA WPAFB 7-2701 Z AZ80 OCS 3 7080	X03907 ↓ L04122
L04548/L04135/L04122 =	L04220
20F ES D056E 0180 U 001 C130E 76 OCT-77 MAY 77171 SP ASD/ENESA WPAFB 7-2679 Z AC66 OCS 3 7080	X03902 ↓ L01518/L01549

C130E

20F ES D056E 0180 U 002 C130E 76OCT-77MAY 77171 SP ASD/ENESA WPAFB 7-2679 Z AD31 OCS 3 7080	X03903 ↓ L01647/L02574
20F ES D056E 0180 U 003 C130E 76OCT-77MAY 77171 SP ASD/ENESA WPAFB 7-2679 Z AD92 OCS 3 7080	X03904 ↓ L02599/L02857
20F ES D056E 0180 U 004 C130E 76 OCT-77 MAY 77171 SP ASD/ENESA WPAFB 7-2679 Z BF54 OCS 3 7080	X03905 ↓ L02877

L01647/L02574/L02599/L02857/L02877

=

C141A

30F ES D056E 0180 U 001 AC141A 76 JUN-76 SEP 77172 SP ASD/ENESA WPAFB 7-2699 Z AZ19 OCS 3 7080	X 03181 ↓ L06100/L06101
30F ES D056E 0180 U 002 AC141A 76 JUN-76 SEP 77172 SP ASD/ENESA WPAFB 7-2699 Z AZ62 OCS 3 7080	X 03900 ↓ L06102
30F ES D056E 0180 U 003 AC141A 76 JUN-76 SEP 77172 SP ASD/ENESA WPAFB 7-2699 Z AZ63 OCS 3 7080	X 03901 ↓ L06104/L06105

C141A

30F ES D056E 0180 U 001 C141A 76OCT-77MAY 77171 SP ASD/ENESA WPAFB 7-2679 Z AD97 OCS3 7080	X 02619 L06106
30F ES D056E 0180 U 002 C141A 76OCT-77MAY 77171 SP ASD/ENESA WPAFB 7-2679 Z AE06 OCS 3 7080	X 03100 L06108
30F ES D056E 0180 U 003 C141A 76OCT-77MAY 77171 SP ASD/ENESA WPAFB 7-2679 Z AE09 OCS 3 7080	X 03389 L06110/L06111
30F ES D056E 0180 U 004 C141A 76OCT-77MAY 77171 TSP ASD/ENESA WPAFB 7-2679 Z BN67 OCS 3 7080	X 03547 L06112/L06113

30F ES D056E 0180 U 005 C141A : 76 OCT-77 MAY 77171 T SP ASD/ENESA WPAFB 7-2679 Z BN90 OCS 3 7080	X03558 L06114/L06115
30F ES D056E 0180 U 006 C141A 76 OCT-77 MAY 77171 T SP ASD/ENESA WPAFB 7-2679 Z BF48 OCS 3 7080	X03571 L06116/L06117
30F ES D056E 0180 U 007 C141A 76 OCT-77 MAY 77171 SP ASD/ENESA WPAFB 7-2679 Z BF49 OCS 3 7080	X00867 L06118

C130E

INPUT TAPE	OUTPUT TAPE	OUTPUT TAPE
JUN 76 - SEP 76		
X03906	L04548	L04135
X03907	L04122	
OCT 76 - MAY 77		
X03902	L01518	L01549
X03903	L01647	L02574
X03904	L02599	L02857
X03905	L02877	

TAPES WITHDRAWN FROM TAPE LIBRARY (C130E)

L01518	
L01549	
L01647	
L02574	
L02599	
L02857	
L02877	
L03626	PHASE II
L06124	PHASE I

C141A

	INPUT TAPE	OUTPUT TAPE	OUTPUT TAPE
	JUN 76 - SEP 76		
1/3	X03181	L06100	L06101
2/3	X03900	L06102	
3/3	X03901	L06104	L06105
	OCT 76 - MAY 77		
1/7	X02619	L06106	
2/7	X03100	L06108	
3/7	X03389	L06110	L06111
4/7	X03547	L06112	L06113
5/7	X03558	L06114	L06115
6/7	X03571	L06116	L06117
7/7	X00867	L06118	
		L06108 X	~~L06117~~
	L06100 X	~~L06109~~ X	~~L06118~~
	L06101 X	L06110 X	~~L06119~~
	L06102 X	L06111 X	~~L06120~~
	L06103	L06112 X	~~L06121~~
	L06104 X	L06113 X	~~L06122~~
	L06105 X	L06114 X	~~L06123~~
	L06106 X	L06115 X	
	L06107	L06116 X	

TAPE USED	DATE CREATED	TAIL NR	TAIL NR	TAIL NR	TAIL NR	DECK USED & SKIP NR.
L05948	12 OCT 77	0495	0496	0497	0498	CA - N/A
L03845	15 OCT 77	0499	0500	0501	0502	CA - 4
L03996	15 OCT 77	0503	0504	0510	0512	CB - 8
L04359	15 OCT 77	0513	0514	0515	0517	CC - 12
L05949	15 OCT 77	0518	0519	0520	0521	CD - 16
L05287	17 OCT 77	0523	0524	0525	0526	CA - 20
L05299	17 OCT 77	0527	0529	0530	0531	CB - 24
L05344	17 OCT 77	0532	0533	0534	0535	CC - 28
L05948	17 OCT 77	0537	0538	0539	0540	CD - 32
L03845	18 OCT 77	0541	0542	0543	0544	CA - 36
L03996	18 OCT 77	0549	0550	0551	0552	CB - 40
L04359	18 OCT 77	0553	0554	0555	0556	CC - 44
L05949	18 OCT 77	0557	0559	0560	0561	CD - 48
L05287	19 OCT 77	0562	0564	0565	0566	CA - 52
L05299	19 OCT 77	0567	0568	0569	0570	CB - 56
L05344	19 OCT 77	0571	0572	05-4	0934	CC - 60
L05948	19 OCT 77	0935	0936	0937	0938	CD - 64
L03845	20 OCT 77	0939	0940	0941	0942	CA - 68
L03996	20 OCT 77	0943	0944	0945	0946	CB - 72

NR USED	DATE PRINTED	TAIL NR	TAIL NR	TAIL NR	TAIL NR	DECK USED & SKIP NR
L04359	20 OCT 77	0947	0948	0949	0950	CC - 76
L05949	20 OCT 77	0951	1259	1260	1261	CD - 80
L05287	21 OCT 77	1262	1263	1264	1265	CA - 84
L05299	21 OCT 77	1266	1267	1268	1269	CB - 88
L05344	21 OCT 77	1270	1271	1272	1273	CC - 92
L05948	21 OCT 77	1274	1275	1276	1288	CD - 96
L03845	22 OCT 77	1289	1290	1291	1292	CA - 100
L03996	22 OCT 77	1293	1294	1295	1296	CB - 104
L04359	22 OCT 77	1298	1299	1784	1786	CC - 108
L05949	22 OCT 77	1787	1788	1789	1790	CD - 112
L05287	26 OCT 77	1791	1792	1793	1794	CA - 116
L05299	26 OCT 77	1795	1798	1799	1801	CB - 120
L05344	26 OCT 77	1803	1804	1806	1807	CC - 124
L05948	26 OCT 77	1808	1809	1810	1811	CD - 128
L03845	26 OCT 77	1812	1816	1817	1818	CA - 132
L03996	26 OCT 77	1819	181—	1820	1821	CB - 136
L04359	26 OCT 77	1822	1823	1824	1825	CC - 140
L05949	26 OCT 77	1826	1827	1828	1829	CD - 144
L05287	27 OCT 77	1830	1832	1833	1834	CE - 148

NK USED	DATE CREATED	TAIL NK	TAIL NK	TAIL NK	TAIL NK	DECK USED & SKIP NR
L05299	27 OCT 77	1835	1836	1837	1838	CF -152
L05344	27 OCT 77	1839	1842	1843	1844	CG -156
L05948	27 OCT 77	1846	1847	1848	1849	CH -160
L03845	27 OCT 77	1850	1851	1852	1855	CA - 164
L03996	27 OCT 77	1856	1857	1858	1859	CB - 168
L04359	27 OCT 77	1860	1862	1863	1864	CC - 172
L05949	27 OCT 77	1866	2358	2359	2360	CD - 176
L05287	28 OCT 77	2361	2362	2363	2364	CE - 180
L05299	28 OCT 77	2365	2366	2367	2368	CF - 184
L05344	28 OCT 77	2369	2370	2371	2372	CG - 188
L05948	28 OCT 77	2373	6566	6579	6580	CH -192
L03845	28 OCT 77	6581	6582	6583	7680	CA -196
L03996	28 OCT 77	7681	7764	7765	7766	CB -200
L04359	28 OCT 77	7767	7768	7769	7770	CC -204
L05949	28 OCT 77	7771	7773	7776	7777	CD -208
L05287	29 OCT 77	7778	7779	7781	7782	CE - 212
L05299	29 OCT 77	7783	7784	7785	7786	CF 216
L05344	29 OCT 77	7787	7788	7790	7791	CG -220
L05948	29 OCT 77	7792	7793	7794	7795	CH -224

E NUMBER	DATE CREATED	TAIL NR.	TAIL NR.	TAIL NR.	TAIL NR.	DECK USED & SKIP NR
L05948	21 Dec 77	#229 7794	#230 7795	#231 7796	#232 7799	CG – 228
L05949	21 DEC 77	#233 77–1	#234 7800	#235 7803	#236 7804	CH – 232
L04933	21 DEC 77	#237 7805	#238 7806	#239 7807	#240 7808	CI – 236
L04938	21 DEC 77	#241 7809	#242 7811	#243 7812	#244 7813	CJ – 240
L03845	21 DEC 77	#245 7814	#246 7815	#247 7816	#248 7817	CA – 244
L03996	22 DEC 77	#249 7818	#250 7819	#251 7820	#252 7821	CB – 248
L04359	21 DEC 77	#253 7822	#254 7823	#255 7824	#256 7825	CC – 252
L05287	21 DEC 71	#257 7826	#258 7828	#259 7829	#260 7830	CD – 256
L05299	21 DEC 77	#261 7831	#262 7832	#263 7833	#264 7834	CE – 260
L05344	21 DEC 77	#265 7835	#266 7836	#267 7837	#268 7838	CF – 264
L05948	21 DEC 77	#269 7839	#270 7840	#271 7841	#272 7842	CG – 268
L05949	21 DEC 77	#273 7845	#274 7846	#275 7847	#276 7848	CH – 272
L04933	21 DEC 77	#277 7849	#278 7850	#279 7851	#280 7852	CI – 276
L04938	21 DEC 77	#281 7853	#282 7854	#283 7856	#284 7857	CJ – 280
L03845	22 DEC 77	#285 7858	#286 7859	#287 7860	#288 7861	CA – 284
L03996	22 DEC 77	#289 7863	#290 7864	#291 7865	#292 7866	CB – 288
L04359	22 DEC 77	#293 7867	#294 7868	#295 7869	#296 7871	CC – 292
[illegible]	[illegible] DEC [illegible]	[illegible] 7872	[illegible] 7874	[illegible] 7876	#300 7877	CD – 296
L05299	22 DEC 77	#301 7879	#302 7880	#303 7881	#304 7882	CE – 300

[illegible] NUMBER	DATE CREATED	TAIL NR.	TAIL NR.	TAIL NR.	TAIL NR.	DECK USED 4 SKIP NUMBER
LO5344	22 DEC 77	#305 7883	#306 7884	#307 7885	#308 7887	CF - 304
LO5948	22 DEC 77	#309 7888	#310 7889	#311 7890	#312 789L	CG - 300
LO5949	22 DEC 77	#313 7892	#314 7893	#315 7894	#316 7895	CH - 312
LO4933	22 DEC 77	#317 7896	#318 7897	#319 7898	#320 7899	CI - 316
LO4938	22 DEC 77	#321 78-4	#322 7-1-	#323 7-42	#324 7-46	CJ - 320
LO 3845	22 DEC 77	#325 7-66	#326 8240	#327 9810	#328 9811	CA - 324
LO3996	22 DEC 77	#329 9812	#330 9813	#331 9814	#332 9815	CB - 328
LO 4359	23 DEC 77	#333 9816	#334 9817	#335 9990	#336 9999	CC - 332
LO5287	22 DEC 77	#337 9-99	#338 -806	#339 -828	#340 -831	CD - 336
LO5299	22 DEC 77	#341 - 837	#342 -85L			CE - 340

[illegible] NUMBER	DATE CREATED	TAIL NR		TAIL NR		TAIL NR		TAIL NR		DECK USED & SKIP NUMBER
L05344	22 DEC 77	#1	Z013	#2	0001	#3	0002	#4	0003	CF – 0
L03845	23 DEC 77	#5	0004	#6	0005	#7	0006	#8	0007	CA – 4
L03996	23 DEC 77	#9	0009	#10	0010	#11	0011	#12	0012	CB – 8
L04359	23 DEC 77	#13	0013	#14	0015	#15	0017	#16	0018	CC – 12
L05287	23 DEC 77	#17	0019	#18	0020	#19	0021	#20	0022	CD – 16
L05299	23 DEC 77	#21	0023	#22	0024	#23	0025	#24	0026	CE – 20
L05344	23 DEC 77	#25	0027	#26	0029	#27	0030	#28	0031	CF – 24
L05948	28 DEC 77	#29	0128	#30	0129	#31	0130	#32	0132	CG – 28
L05949	23 DEC 77	#33	0133	#34	0137	#35	0138	#36	0139	CH – 32
L04933	23 DEC 77	#37	0140	#38	0141	#39	0142	#40	0143	CI – 36
L04938	23 DEC 77	#41	0145	#42	0146	#43	0147	#44	0148	CJ – 40
L03810	28 DEC 77	#45	0149	#46	0150	#47	0151	#48	0153	CA – 44
L03996	28 DEC 77	#49	0154	#50	0155	#51	0156	#52	0157	CB – 48
L04359	27 DEC 77	#53	0158	#54	0159	#55	0160	#56	0161	CC – 52
L05287	27 DEC 77	#57	0162	#58	0164	#59	0165	#60	0166	CD – 56
L05299	27 DEC 77	#61	0170	#62	0171	#63	0172	#64	0173	CE – 60
L05344	27 DEC 77	#65	0176	#66	0177	#67	0178	#68	0179	CF – 64
L05948	27 DEC 77	#69	0180	#70	0181	#71	0182	#72	0183	CG – 68
L05949	27 DEC 77	#73	0184	#74	0185	#75	0188	#76	0189	CH – 72

NUMBER	DATE CREATED	TAIL NR	TAIL NR	TAIL NR	TAIL NR	DECK USED & SKIP NUMBER
LO4933	27 DEC 77	#77 0190	#78 0191	#79 0192	#80 0193	CI - 76
LO4938	27 DEC 77	#81 0194	#82 0197	#83 0198	#84 0200	CJ - 80
LO3810	27 DEC 77	#85 0201	#86 0205	#87 0206	#88 0207	CA - 84
LO3996	27 DEC 77	#89 0208	#90 0216	#91 0217	#92 0219	CB - 88
LO4359	28 DEC 77	#93 0221	#94 0223	#95 0224	#96 0225	CC - 92
LO5287	28 DEC 77	#97 0226	#98 0227	#99 0228	#100 0229	CD - 96
LO5299	27 DEC 77	#101 0230	#102 0231	#103 0232	#104 0233	CE - 100
LO5344	27 DEC 77	#105 0234	#106 0235	#107 0236	#108 0237	CF - 104
LO5948	27 DEC 77	#109 0238	#110 0239	#111 0240	#112 0241	CG - 108
LO5949	27 DEC 77	#113 0242	#114 0243	#115 0244	#116 0245	CH - 112
LO4933	27 DEC 77	#117 0246	#118 0247	#119 0248	#120 0249	CI - 116
LO4938	27 DEC 77	#121 0250	#122 0251	#123 0252	#124 0253	CJ - 120
LO3810	28 DEC 77	#125 0254	#126 0255	#127 0256	#128 0257	CA - 124
LO3996	28 DEC 77	#129 0258	#130 0259	#131 0260	#132 0261	CB - 128
LO4359	28 DEC 77	#133 0262	#134 0263	#135 0264	#136 0265	CC - 132
LO5287	28 DEC 77	#137 0268	#138 0271	#139 0275	#140 0276	CD - 136
LO5299	28 DEC 77	#141 0277	#142 0278	#143 0280	#144 0609	CE - 140
LO5344	28 DEC 77	#145 0611	#146 0614	#147 0616	#148 0617	CF - 144
LO5948	28 DEC 77	#149 0619	#150 0620	#151 0621	#152 0622	CG - 148

E NUMBER	DATE CREATED	TAIL NR	TAIL NR	TAIL NR	TAIL NR	DECK USED + SKIP NUMBERS
L05949	28 DEC 77	#153 0623	#154 0625	#155 0626	#156 0627	CH -152
L04933	28 DEC 77	#157 0628	#158 0632	#159 0633	#160 0634	CI -156
L04938	28 DEC 77	#161 0635	#162 0636	#163 0637	#164 0638	CJ -160
L03810	30 DEC 77	#165 0639	#166 0640	#167 0642	#168 0643	CA -164
L03996	29 DEC 77	#169 0644	#170 0645	#171 0646	#172 0647	CB -168
L04359	28 DEC 77	#173 0648	#174 0649	#175 0650	#176 0652	CC -172
L05287	29 DEC 77	#177 0653	#178 2775	#179 2776	#180 2777	CD -176
L05299	28 DEC 77	#181 2778	#182 2779	#183 4610	#184 4611	CE -180
L05344	28 DEC 77	#185 4612	#186 4613	#187 4615	#188 4618	CF -184
L05948	28 DEC 77	#189 4624	#190 4629	#191 4630	#192 4631	CG -188
L05949	29 DEC 77	#193 4633	#194 4639	#195 4642	#196 4644	CH -192
L04933	29 DEC 77	#197 4647	#198 4651	#199 5217	#200 5218	CI -196
L04938	28 DEC 77	#201 5220	#202 5222	#203 5265	#204 5266	CJ -200
L03810	29 DEC 77	#205 5267	#206 5269	#207 5270	#208 5272	CA -204
L03996	29 DEC 77	#209 5273	#210 5279	#211 6126	#212 6131	CB -208
L04359	29 DEC 77	#213 6134	#214 6135	#215 6136	#216 6137.	CC -212
L05287	29 DEC 77	#217 6144	#218 6152	#219 6162	#220 6163	CD -216
L05299	29 DEC 77	#221 6164	#222 6166	#223 6167	#224 6168	CE -220
L05344	29 DEC 77	#225 6169	#226 6174	#227 6175	#228 6186	CF -224

[redacted]

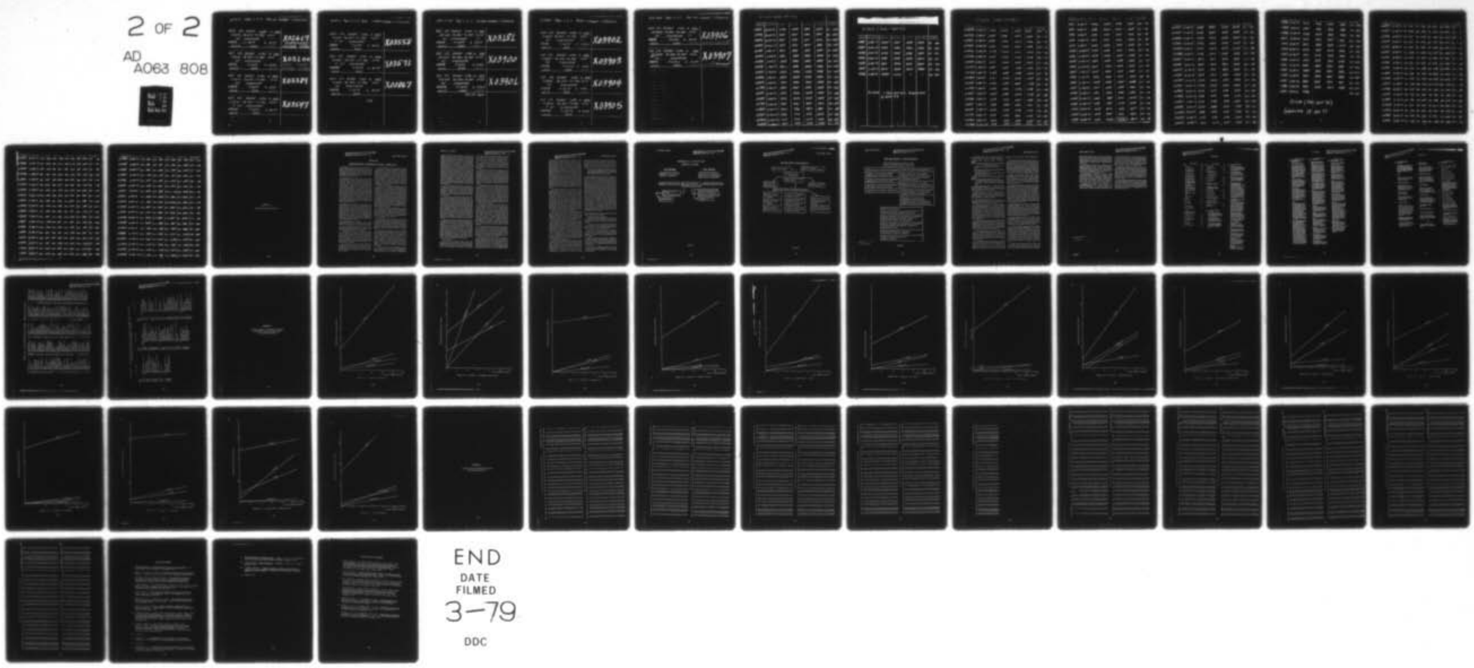
DE NUMBER	DATE CREATED	TAIL NR	TAIL NR	TAIL NR	TAIL NR	DECK USED BY SHIP NUMBER
05948	29 DEC 77	#229 6187	#230 6195	#231 6196	#232 6199	CG - 228
05949	29 DEC 77	#233 6202	#234 6203	#235 6204	#236 6207	CH - 232
04933	29 DEC 77	#237 6209	#238 7003	#239 7012	#240 7014	CI - 236
04938	29 DEC 77	#241 7016	#242 7028	#243 7944	#244 7945	CJ - 240
03810	30 DEC 77	#245 7946	#246 7947	#247 7948	#248 7949	CA - 244
03996	30 DEC 77	#249 7950	#250 7951	#251 7952	#252 7953	CB - 248
04359	29 DEC 77	#253 7954	#254 7955	#255 7956	#256 7957	CC - 252
05287	29 DEC 77	#257 7958	#258 7959	#259 8075	#260 8076	CD - 256
05299	29 DEC 77	#261 8078	#262 8079	#263 8080	#264 8081	CE - 260
05344	29 DEC 77	#265 8082	#266 8083	#267 8084	#268 8085	CF - 264
05948	29 DEC 77	#269 8086	#270 8087	#271 8088	#272 8089	CG - 268
05949	29 DEC 77	#273 8090	#274 9090	#275 9397	#276 9398	CH - 272
04933	29 DEC 77	#277 9399	#278 9400	#279 9401	#280 9402	CI - 276
04938	30 DEC 77	#281 9403	#282 9404	#283 9405	#284 9406	CJ - 200
03810	29 DEC 77	#285 9408	#286 9409	#287 9410	#288 9411	CA - 284
03996	29 DEC 77	#289 9412	#290 9413	#291 9414	#292 9990	CB - 288
04359	29 DEC 77	#293 9999				CC - 292

7 TRACK TAPE CREATE (STEP II)

TAPE	INPUT TAPE	INPUT TAPE	INPUT TAPE	OUTPUT TAPE	OUTPUT TAPE	OUTPUT
C130E - JUN 76 THRU SEP 76						
L04548	L04135	L04122	—	L04220		
C130E - OCT 76 THRU MAY 77						
L01518	L01549	L01677	L02574			
L02577	L02857	L02877		L06119		
C141A - JUN 76 THRU SEP 76						
L06100	L06101	L06102	L06104			
L06105						
C141A - OCT 76 THRU MAY 77						
L06106	L06108	L06110	L06111		L06119	
L06112	L06113	L06114	L06115		L06120	
L06116	L06117	L06118				

AD-A063 808 AERONAUTICAL SYSTEMS DIV WRIGHT-PATTERSON AFB OHIO F/G 1/3
A METHOD FOR ADJUSTING MAINTENANCE FORECASTS TO ACCOUNT FOR PLA--ETC(U)
AUG 78 L D HOWELL
UNCLASSIFIED ASD-TR-78-26 NL

2 OF 2
AD
A063 808



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DATE
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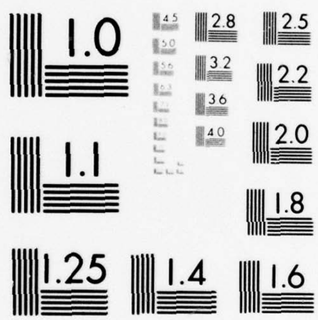
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1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0

C141A. Page 1 of 2 PROBLEM NUMBER = E740052

30F ES D056E 0180 U 001 C141A 76 OCT-77 MAY 77171 SP ASD/ENESA WPAFB 7-2679 Z AD97 OCS3 7080 10880	X02619 L03848/L03381 3466 blocks 168 blocks
30F ES D056E 0180 U 002 C141A 76 OCT-77 MAY 77171 SP ASD/ENESA WPAFB 7-2679 Z AE06 OCS3 7080 04675	X03100 L02951 / L00812 3197 blocks 4376 blocks
30F ES D056E 0180 U 003 C141A 76 OCT-77 MAY 77171 SP ASD/ENESA WPAFB 7-2679 Z AE09 OCS3 7080 04517	X03389
30F ES D056E 0180 U 004 C141A 76 OCT-77 MAY 77171 T SP ASD/ENESA WPAFB 7-2679 Z BN67 OCS3 7080 01130	X03547

C141A Page 2 of 2 Pages PROBLEM NUMBER = E740052

30F ES D056E 0180 U 005 C141A 76 OCT-77 MAY 77171 T SP ASD/ENESA WPAFB 7-2679 Z BN90 OCS3 7080	X03558
30F ES D056E 0180 U 006 C141A 76 OCT-77 MAY 77171 T SP ASD/ENESA WPAFB 7-2679 Z BF48 OCS3 7080	X03571
30F ES D056E 0180 U 007 C141A 76 OCT-77 MAY 77171 SP ASD/ENESA WPAFB 7-2679 Z BF49 OCS3 7080	X00867

SRD

AC141A Page 1 OF 1 PROBLEM NUMBER = E740052

30F ES D056E 0180 U 001 AC141A 76 JUN-76 SEP 77172 SP ASD/ENESA 27 WPAFB 7-2699 Z AZ19 OCS3 7080 0486	X0318L
30F ES D056E 0180 U 002 AC141A 76 JUN-76 SEP 77172 SP ASD/ENESA WPAFB 7-2699 Z AZ62 OCS3 7080 50791	X03900
30F ES D056E 0180 U 003 AC141A 76 JUN-76 SEP 77172 SP ASD/ENESA WPAFB 7-2699 Z AZ63 OCS3 7080 03993	X0390L
EQCLAS DATA	

C130E Page 1 of 1 PROBLEM NUMBER = E740052

2OF ES D056E 0180 U 001 C130E: 76 OCT - 77 MAY 77171 SP ASD/ENESA [illegible] WPAFB 7-2679 Z AC66 OCS 3 7080 00787	X03902
2OF ES D056E 0180 U 002 C130E 76 OCT - 77 MAY 77171 SP ASD/ENESA WPAFB 7-2679 Z AD3L OCS 3 7080 30792	X03903
2OF ES D056E 0180 U 003 C130E 76 OCT - 77 MAY 77171 SP ASD/ENESA WPAFB 7-2679 Z AD91 OCS 3 7080 31380	X03904
2OF ES D056E 0180 U 004 C130E 76 OCT - 77 MAY 77171 T SP ASD/ENESA WPAFB 7-2679 Z BF54 OCS3 7080 19559	X03905

AC130E Page 1 OF 1 PROBLEM NUMBER = E740052

20F ES D056E 0180 U 001 AC130E 76 JUN - 76 SEP 77172 SP ASD/ENESA CP 3 WPAFB 7-2701 Z AZ74 OCS3 7080 03776	X03906 L04545/L04135
20F ES D056E 0180 U 002 AC130E 76 JUN - 76 SEP 77172 SP ASD/ENESA 4 WPAFB 7-2701 Z AZ80 OCS3 7080 15123	X03907 L04122/ ~~L04322~~

C130E (JUN-SEP 76)

NR USED	DATE CREATED	TAIL NR	TAIL NR	TAIL NR	TAIL NR	DECK USED & SKIP NR
L03845	31 OCT 77	7796	7799	7800	7803	CA - 228
L03996	31 OCT 77	7804	7805	7806	7807	CB - 232
L04359	31 OCT 77	7808	7809	7811	7812	CC - 236
L05949	31 OCT 77	7813	7814	7815	7816	CD - 240
L05287	1 NOV 77	7817	7818	7819	7820	CE - 244
L05299	1 NOV 77	7821	7822	7823	7824	CF - 248
L05344	1 NOV 77	7825	7826	7828	7829	CG - 252
L05948	1 NOV 77	782–	7830	7831	7832	CH - 256
L03845	1 NOV 77	7833	7834	7835	7836	CA - 260
L03996	1 NOV 77	7837	7838	7839	7840	CB - 264
L04359	1 NOV 77	7841	7842	7845	7846	CC - 268
L05949	1 NOV 77	7847	7848	7849	7850	CD - 272
L05287	2 NOV 77	7851	7852	7853	7854	CE - 276
L05299	2 NOV 77	7856	7857	7858	7859	CF - 280
L05344	2 NOV 77	7860	7861	7863	7864	CG - 284
L05948	2 NOV 77	7865	7866	7867	7868	CH - 288
L03845	2 NOV 77	7869	7871	7872	7874	CA - 292
L03996	2 NOV 77	7876	7877	7879	7880	CB - 296
L04359	2 NOV 77	7881	7882 94	7883	7884	CC - 300

[redacted]

C130E (JUN - SEP 76)

NR USED	DATE ISSUED	TAIL NR	TAIL NR	TAIL NR	TAIL NR	BLOCK USED & SKIP NR
5949	2 Nov 77	7885	7887	7888	7889	CD -304
05287	3 Nov 77	7890	7891	7892	7893	CE -308
05299	3 Nov 77	7894	7895	7896	7897	CF - 312
5344	3 Nov 77	7898	7899	8240	9810	CG - 316
5948	3 Nov 77	9811	9812	9813	9814	CH - 320
3845	4 Nov 77	9815	9816	9817	9990	CA - 324
3996	4 Nov 77	9999	E872	—	—	CB -328

C130E (JUN-SEP 76) COMPLETED 4 NOV 77

C141A (JUN-SEP76)

[illegible] NR USED	DATE CREATED	TAIL NR	TAIL NR	TAIL NR	TAIL NR	DECK USED SKIP NR.
L05299	5 NOV77	0001	0002	0003	0004	CE- 0
L05344	5 NOV77	0005	0006	0007	0008	CF - 4
L05948	5 NOV77	0009	0010	0011	0012	CG - 8
L05949	5 NOV77	0013	0015	0017	0018	CH - 12
L03845	5 NOV 77	0019	0020	0021	0022	CA - 16
L03996	5 NOV 77	0023	0024	0025	0026	CB - 20
L04359	5 NOV 77	0027	0029	0030	0031	CC - 24
L05287	5 NOV 77	0128	0129	0130	0132	CD - 28
L05299	7 NOV 77	0133	0138	0139	0140	CE - 32
L05344	7 NOV77	0141	0142	0143	0145	CF - 36
L05948	7 NOV 77	0146	0147	0148	0149	CG - 40
L05949	7 NOV77	0150	0151	0153	0154	CH - 44
L03845	7 NOV 77	0155	0156	0157	0158	CA - 48.
L03996	7 NOV 77	0159	0160	0161	0164	CB - 52.
L04359	7 NOV 77	0165	0166	0170	0171	CC - 56.
L05287	7 NOV 77	0172	0173	0176	0177	CD- 60.
L05299	8 NOV 77	0178	0179	0180	0181	CE - 64
L05344	8 NOV 77	0182	0183	0184	0185	CF- 68
L05948	8 NOV.77	0188	0189	0190	0191	CG - 72

NUMBER	DATE CREATED	TAIL NR	TAIL NR	TAIL NR	TAIL NR	DECK USED + SKIP NR.
5949	8 NOV 77	0192	0193	0194	0197	CH - 76
3845	9 NOV 77	0198	0200	0201	0205	CA - 80
3996	9 NOV 77	0206	0207	0208	0216	CB - 84
4359	9 NOV 77	0219	0221	0223	0224	CC - 88
5287	9 NOV 77	0225	0226	0227	0228	CD - 92
05299	10 NOV 77	0229	0230	0231	0232	CE - 96
05344	10 NOV 77	0233	0234	0235	0236	CF - 100
05948	10 NOV 77	0237	0238	0239	0240	CG - 104
05949	10 NOV 77	0241	0242	0243	0244	CH - 108
03845	11 NOV 77	0245	0246	0247	0248	CA - 112
03996	11 NOV 77	0249	0250	0251	0252	CB - 116
04359	11 NOV 77	0253	0254	0255	0256	CC - 120
05287	11 NOV 77	0257	0258	0259	0260	CD - 124
05299	12 NOV 77	0261	0262	0263	0264	CE - 128
05344	12 NOV 77	0265	0268	0271	0275	CF - 132
05948	12 NOV 77	0276	0277	0278	0280	CG - 136
05949	12 NOV 77	0609	0614	0616	0617	CH - 140
03845	14 NOV 77	0619	0620	0621	0622	CA - 144
03996	14 NOV 77	0623	0625	0626	0627	CB - 148

L NUMBER	DATE CREATED	TAIL NR.	TAIL NR.	TAIL NR.	TAIL NR.	DECK USED + SKIP NR.
L04359	14 Nov 77	0628	0632	0634	0635	CC - 152
L05287	14 Nov 77	0636	0637	0638	0639	CD - 156
L05299	14 Nov 77	0640	0642	0643	0645	CE - 160
L05344	14 Nov 77	0646	0647	0648	0649	CF - 164
L05948	14 Nov 77	0650	0652	0653	2775	CG - 168
L05949	14 Nov 77	2776	2777	2778	2779	CH - 172
L03845	15 Nov 77	4610	4611	4612	4613	CA - 176
L03996	15 Nov 77	4615	4618	4624	4629	CB - 180
L04359	15 Nov 77	4630	4631	4633	4644	CC - 184
L05287	15 Nov 77	4652	5217	5218	5220	CD - 188
L05299	15 Nov 77	5222	5266	5267	5269	CE - 192
L05344	15 Nov 77	5270	5272	5273	5279	CF - 196
L05948	15 Nov 77	6126	6132	6134	6135	CG - 20[illegible]
L05949	15 Nov 77	6136	6137	6144	6152	CH - 20[illegible]
L03845	15 Nov 77	6162	6163	6164	6167	CA - 20[illegible]
L03996	15 Nov 77	6168	6169	6174	6175	CB - 21[illegible]
L04359	15 Nov 77	6186	6187	6193	6194	CC - 21[illegible]
L05287	15 Nov 77	6195	6196	6199	6202	CD - 22[illegible]
L05299	15 Nov 77	6203	6204	6205	6209	CE - 22[illegible]

E NUMBER	DATE CREATED	TAIL NR	TAIL NR	TAIL NR	TAIL NR	DECK USED & SKIP NR
5344	15 Nov 77	7014	7016	7028	7944	CF - 228
5948	15 Nov 77	7945	7946	7947	7948	CG - 232
5949	15 Nov 77	7949	7950	7951	7952	CH - 236
3845	16 Nov 77	7953	7954	7955	7956	CA - 240
3996	16 Nov 77	7957	7958	7959	8075	CB - 244
4359	16 Nov 77	8076	8078	8079	8080	CC - 248
5287	16 Nov 77	8081	8082	8083	8084	CD - 252
5299	17 Nov 77	8085	8086	8087	8088	CE - 256
5344	17 Nov 77	8089	8090	9397	9398	CF - 260
5948	17 Nov 77	9399	9400	9401	9402	CG - 264
5949	17 Nov 77	9403	9404	9405	9406	CH - 268
3845	17 Nov 77	9408	9409	9410	9411	CA - 272
3996	17 Nov 77	9412	9413	9414	9990	CB - 276
5287	17 Nov 77	9999				CD - 280

C141A (JUN-SEP 76)

COMPLETED 18 NOV 77

E NUMBER	DATE CREATED	TAIL NR.	TAIL NR.	TAIL NR.	TAIL NR.	[illegible] USED & SKIP NR
L03845	15 DEC 77	#1 0495	#2 0496	#3 0497	#4 0498	CA - 0
L03845	16 DEC 77	#5 0499	#6 0500	#7 0501	#8 0502	CA - 4
L03996	16 DEC 77	#9 0503	#10 0504	#11 0510	#12 0512	CB - 8
L04359	16 DEC 77	#13 0513	#14 0514	#15 0515	#16 0517	CC - 12
L05287	16 DEC 77	#17 0518	#18 0519	#19 0520	#20 0521	CD - 16
L05299	16 DEC 77	#21 0523	#22 0524	#23 0525	#24 0526	CE - 20
L05344	16 DEC 77	#25 0527	#26 0529	#27 0530	#28 0531	CF - 24
L05948	16 DEC 77	#29 0532	#30 0533	#31 0534	#32 0535	CG - 28
L05949	16 DEC 77	#33 0537	#34 0538	#35 0539	#36 0540	CH - 32
L04933	16 DEC 77	#37 0541	#38 0542	#39 0543	#40 0544	CI - 36
L04938	16 DEC 77	#41 0549	#42 0550	#43 0551	#44 0552	CJ - 40
L03845	16 DEC 77	#45 0553	#46 0554	#47 0555	#48 0556	CA - 44
L03996	16 DEC 77	#49 0557	#50 0559	#51 0560	#52 0561	CB - 48
L04359	16 DEC 77	#53 0562	#54 0564	#55 0565	#56 0566	CC - 52
L05287	16 DEC 77	#57 0567	#58 0568	#59 0569	#60 0570	CD - 56
L05299	16 DEC 77	#61 0571	#62 0572	#63 05_4	#64 0934.	CE - 60
L05344	16 DEC 77	#65 0935	#66 0936	#67 0937	#68 0938	CF - 64
L05948	16 DEC 77	#69 0939	#70 0940	#71 0941	#72 0942	CG - 68
L05949	16 DEC 77	#73 0943	#74 0944	#75 0945	#76 0946	CH - 72

[illegible]E NUMBER	DATE CREATED	TAIL NR.		TAIL NR.		TAIL NR.		TAIL NR.		DECK USE SHIP NR.
L04933	16 DEC 77	#77	0947	#78	0948	#79	0949	#80	0950	CI -76
L04938	16 DEC 77	#81	0951	#82	09[illegible]2	#83	0[illegible]53	#84	1259	CJ -80
L03845	17 DEC 77	#85	1260	#86	1261	#87	1262	#88	1263	CA -84
L03996	17 DEC 77	#89	1264	#90	1265	#91	1266	#92	1267	CB -88
L04359	17 DEC 77	#93	1268	#94	1269	#95	1270	#96	1271	CC -92
L05287	17 DEC 77	#97	1272	#98	1273	#99	1274	#100	1275	CD -96
L05299	17 DEC 77	#101	1276	#102	1288	#103	1289	#104	1290	CE -100
L05344	17 DEC 77	#105	1291	#106	1292	#107	1293	#108	1294	CF -104
L05948	17 DEC 77	#109	1295	#110	1296	#111	1298	#112	1299	CG -108
L05949	17 DEC 77	#113	1784	#114	1786	#115	1787	#116	1788	CH -112
04933	17 DEC 77	#117	1789	#118	1790	#119	1791	#120	1792	CI -116
04938	17 DEC 77	#121	1793	#122	1794	#123	1795	#124	1798	CJ -120
03845	19 DEC 77	#125	1799	#126	1801	#127	1803	#128	1804	CA -124
03996	19 DEC 77	#129	1806	#130	1807	#131	1808	#132	1809	CB -128
04359	19 DEC 77	#133	1810	#134	1811	#135	1812	#136	1816	CC -132
05287	19 DEC 77	#137	1817	#138	1818	#139	1819	#140	1820	CD -136
05299	19 DEC 77	#141	1821	#142	1822	#143	1823	#144	1824	CE -140
05344	19 DEC 77	#145	1825	#146	1826	#147	1827	#148	1828	CF -144
05948	19 DEC 77	#149	1829	#150	1830	#151	1832	#152	1833	CG -148

E NUMBER	DATE CREATED	TAIL NR	TAIL NR.	TAIL NR.	TAIL NR.	DECK USED & SKIP NR.
L05949	19 DEC 77	#153 1834	#154 1835	#155 1836	#156 1837	CH - 152
L04933	19 DEC 77	#157 1838	#158 1839	#159 1842	#160 1843	CI - 156
L04938	19 DEC 77	#161 1844	#162 1846	#163 1847	#164 1848	CJ - 160
L03845	20 DEC 77	#165 1849	#166 1850	#167 1851	#168 1852	CA - 164
L03996	20 DEC 77	#169 1855	#170 1856	#171 1857	#172 1858	CB - 168
L04359	20 DEC 77	#173 1859	#174 1860	#175 1862	#176 1863	CC - 172
L05287	20 DEC 77	#177 1864	#178 1866	#179 1_36	#180 2358	CD - 176
L05299	20 DEC 77	#181 2359	#182 2360	#183 2361	#184 2362	CE - 180
L05344	20 DEC 77	#185 2363	#186 2364	#187 2365	#188 2366	CF - 184
L05948	20 DEC 77	#189 2367	#190 2368	#191 2369	#192 2370	CG - 188
L05949	20 DEC 77	#193 2371	#194 2372	#195 2373	#196 6566	CH - 192
L04933	20 DEC 77	#197 6579	#198 6580	#199 6581	#200 6582	CI - 196
L04938	20 DEC 77	#201 6583	#202 7680	#203 7681	#204 7764	CJ - 200
L03845	21 DEC 77	#205 7765	#206 7766	#207 7767	#208 7768	CA - 204
L03996	21 DEC 77	#209 7769	#210 7770	#211 7771	#212 7773	CB - 208
L04359	21 DEC 77	#213 7776	#214 7777	#215 7778	#216 7779	CC - 212
L05287	21 DEC 77	#217 7781	#218 7782	#219 7783	#220 7784	CD - 216
L05299	21 DEC 77	#221 7785	#222 7786	#223 7787	#224 7788	CE - 220
L05344	21 DEC 77	#225 7790	#226 7791	#227 7792	#228 7793	CF - 224

APPENDIX B

Selected Reference Material

Chapter 9

MAINTENANCE EXPERIENCE DATA (AFM 66-1)

9-1. PURPOSE. The purpose of this chapter is to outline the Maintenance Data Collection (MDC) system established by AFR 66-14 and AFM 66-1. The MDC is the primary source for Air Force reliability and maintainability data; therefore, basic understanding of its objectives, uses, and limitations is essential to R & M data users.

9-2. OBJECTIVES. The Maintenance Data Collection system was designed primarily as a base level production credit and management information system. The objectives are to provide maintenance managers with information about the production accomplished by the assigned maintenance personnel; and to identify the equipment on which work was accomplished, why the work was required, and the action required to complete the job. The MDC system identifies maintenance requirements and problem areas so that appropriate management action can be taken to effectively support and meet the established operational requirements. In addition, the MDC system is designed to provide data to AFLC for maintenance engineering and logistics management. Selected data is also provided to the major commands and HQ USAF in accordance with AFMs 66-267 and 66-271.

9-3. SCOPE. The MDC system is applicable to all functions outlined in AFM 66-1, and requires that all maintenance actions involving direct labor expenditures be recorded and reported in this system unless exempted by TO 00-20-2. The system is applicable to the life cycle of aircraft, missiles, ground communications, electronics, and meteorological equipment, and related end items beginning with operational test and evaluation as described in AFR 80-14. This includes compatible data reporting on contractor maintained equipment and maintenance accomplished in depot facilities.

9-4. DOCUMENTATION CONCEPT. The AFTO Forms 346, 349, and 350 are used as source documents for the maintenance data collection system.

a. Recording Concept procedures are divided into two basic categories identified as on-equipment and off-equipment maintenance documentation.

(1) Maintenance actions accomplished on complete end items of equipment (aircraft, missiles, removed engines, ground communications-electronics-meteorological (CEM), trainers, Aerospace Ground Equipment (AGE) and nuclear weapons) are identified as on-equipment work. This primarily consists of support general tasks, inspections, removal and replacement of components, fix-in-place maintenance actions, and modifications.

(2) In-shop maintenance actions involving intermediate level maintenance on removed components is identified as off-equipment maintenance. This primarily consists of bench check, repair or modification of components and assemblies, and nondestructive inspection.

(3) If maintenance is done on components that are removed or removed and replaced to facilitate maintenance in the same room or one immediately adjacent to the end item; this is recorded as on-equipment maintenance. If the individual that removed the component has to leave the immediate area (defined as out-of-sight), an AFTO Form 350 will be prepared to identify the status of the removed component. In this regard, when personnel from one workcenter remove an item and send it to personnel with a different workcenter code for maintenance, the latter workcenter will record it as off-equipment maintenance.

(4) Due to management requirements, unique procedures exist for engines. All maintenance accomplished on gas turbine and reciprocating engines installed in aircraft, missiles, or AGE will be recorded as on-equipment maintenance. Removal and replacement of gas turbine and reciprocating engines for aircraft, missiles, or AGE will be recorded as on-equipment maintenance with the engine treated as a component. Shop work on all removed gas turbine engines and aircraft reciprocating engines will be treated as end item maintenance with on-equipment and off-equipment recording concepts applying. (TO 00-20-2-4). Shop work on reciprocating engines removed from AGE will be treated as component maintenance and the off-equipment maintenance concept will apply.

(5) Each workcenter participating in a job will record maintenance actions and labor expenditures. The documentation responsibility rests with the senior representative from the workcenter. These documents will be returned to the workcenter supervisor who will check for accuracy and completeness prior to submission for processing.

b. Data Forms:

(1) Use of the AFTO Form 349. The AFTO Form 349, "Maintenance Data Collection Record," was designed with sufficient flexibility for use by the majority of organizations in recording maintenance actions on various types of equipment. Recording and data collection procedures pertaining to this form are outlined in the 00-20-2-series technical orders.

(a) For on-equipment work the primary entries required on the AFTO Form 349 are block 1 (Job Control Number), block 2 (Workcenter), block 3 (ID Number), block 6 (Time, as applicable), and columns B through K. For in-shop engine work, primary entries are required in blocks 1 and 2, block 3 (Engine ID) and in columns B through K. For off-equipment work on removed components, primary entries are required in blocks 1, 2, and block 3 or 5; block 19 (Federal Supply Class (FSC)), block 20 (Part Number), and columns B through K.

(b) Up to five related on-equipment maintenance actions covered by a single job control number against a single ID number, and accomplished by a single workcenter may be reported on a single copy

of the AFTO Form 349. If more action lines are required, another AFTO Form 349 containing the same job control number, ID number and workcenter code is completed and the actions continued. This recording procedure also applies to off-equipment actions; however, on-equipment and off-equipment actions will not be combined on a single copy of the AFTO Form 349. The four items could be reported by a single line entry if the job control number, work unit, action taken, how malfunctioned and when discovered codes are all the same and a unit count of four is entered. Similarly the AFTO Forms 350 prepared for shop processing of the four black boxes may reflect a quantity of more than one only if the job control number, work unit code, federal supply class and part number are the same. If these elements are different, a separate AFTO Form 350 must be prepared for each item. Serially controlled and time change items (with an asterisk in the work unit code manual) must be recorded on an individual basis, (for example, only one item per AFTO Forms 349 and 350).

(c) The AFTO Form 349 can be used for identification of both the end item of equipment and a component for engine change actions, for weapon systems and equipment that are managed under the Advanced Configuration Management System (ACMS), for time change items, for special reporting on tires, and for reporting off-equipment maintenance actions

(2) Use of the AFTO Form 350. The AFTO Form 350, "Reparable Item Processing Tag," is a two-part perforated form that is attached to components that are removed from equipment end items and serves as an identification and status tag. Another important aspect of this form is that it serves as a source document pertaining to Repaired This Station (RTS), Not Repaired This Station (NRTS), and condemnation actions for the supply system. This information is input to the base supply computer to identify stockage requirements. Information pertaining to RTS, NRTS, and condemnations is also forwarded through the supply system to AFLC as factors for computing the world-wide spares requirements. Recording procedures for the AFTO Form 350 are outlined in the 00-20-2-series technical orders.

(3) Use of the AFTO Form 346, "Maintenance Data Collection Production and Scheduling Record." The AFTO Form 346 is used for scheduling the calibration of Precision Measuring Equipment (PME) and for recording all maintenance on precision measurement equipment for input to the MDC system. The AFTO Form 346 may also be used for scheduling calendar maintenance requirements on any equipment within the maintenance complex. Note that this pertains only to calendar requirements. Scheduling procedures pertaining to the AFTO Form 346 are outlined in AFR 66-267. Maintenance recording procedures for the AFTO Form 346 on PME are outlined in TO 00-20-10-6

c. Data Elements:

(1) Job Control Number (JCN). The JCN consists of seven characters, the first three are the Julian date and the last four are a unique job number for that date. This provides a means to tie together all on- and off-equipment actions taken, man-hours expended, and parts consumed to satisfy a maintenance requirement whether it be a discrepancy, an inspection, or a TCTO. Every action taken that is related to a job, regardless of workcenter, time or place, will carry the same job control number that was originally assigned to the job. This procedure is necessary to permit control of all related actions, and to provide the capability to tie them together in data systems to identify the total job for analysis purposes.

(2) Workcenter Code. The workcenter code consists of five characters that identify organizational elements to which maintenance personnel are assigned, or locations to which they may be dispatched. Standard workcenter codes are used by all organizations engaged in the maintenance functions outlined in AFM 66-1. In general, the code entered in the workcenter block of the AFTO Form 349 indicates the workcenter of the individual doing the work and not necessarily where the work is accomplished.

(3) Identification (ID) Number. The ID number consists of six characters, and is used to identify equipment on which work was performed or from which an item was removed. The first character of the ID number is the first character of the owning workcenter code. The second character of the ID number is the first character (prefix) of the equipment classification code such as A for aircraft, B for Ground Radar or M for Ground Launched Missiles (AFM 300-4, ADE MA-156-XI). The last four characters of the ID number normally are the last four positions of the equipment serial number. Detailed procedures for assigning ID numbers are contained in AFM 66-267.

(4) Equipment Classification Code. The equipment classification code consists of three characters, and is assigned to identify aircraft, missiles, ground communications, electronics, and meteorological equipment, AGE, trainers, engines, ground launched missile real property installed equipment, munitions, and precision measurement equipment. Codes are also assigned for research and development and shop work. Most of the equipment classification codes are assigned to specific equipment such as LGM-30B missiles. Some of the codes are assigned by category of equipment or work such as non-registered AGE and shop work that is not identified to a weapon or support system. The authorized equipment classification codes are contained in TO 00-20-2.

(5) Type Maintenance Code. The type maintenance code consists of one character and is used to identify the type of work that was accomplished such as scheduled or unscheduled maintenance. Type maintenance codes are listed in each work unit code manual for individual types of equipment. A complete list of authorized type maintenance codes is contained in AFM 300-4, volume XI.

(6) Work Unit Code. The work unit code consists of five characters, and is used to identify the system, subsystem, and component on which maintenance is required or on which maintenance was accomplished. These codes are published in work unit code manuals for each weapon and support system and in code manuals by type of equipment for selected ground CEM, trainers, AGE, munitions, PME,

and shop work. A limited number of work unit codes are assigned in a special category to identify tasks of a general nature such as equipment servicing, cleaning, inspection, storage, ground safety, record keeping, weapons handling, and repetitive shop tasks. Although they are work unit codes, they are identified as "Support General Codes." The first two positions of the work unit codes for aircraft, ground radar, and missiles are standard system codes. They identify functional systems such as flight control system, codes antenna system, or launch control system. The first two positions of the work unit codes for support equipment identify types of equipment, such as ground powered generators, or end items of equipment, such as a trainer. The first position of support general codes begin with a zero; and this is standard in all work unit code manuals. The third and fourth positions of the work unit code identify subsystem or major assembly. The fifth position of the work unit code normally identifies repairable items.

(7) Units Completed. The work unit code in combination with an action taken code is used to describe a "unit of work." An entry of one or more units completed must also be made in the UNITS block of the data collection form in order to show a completed action. An example of a unit of work would be a work unit code for an antenna, with an action taken code for removed and replaced, and a unit count of one, for example, one antenna removed and replaced. By using additional codes to identify the end item, the type of maintenance being accomplished, when the maintenance requirement was discovered, how the item malfunctioned, and the time expended in accomplishing the work, and the production credit system also provides information essential for maintenance and materiel management.

(8) Action Taken Code. The action taken code consists of one character used to identify the maintenance action that was taken, such as remove and replace. Action taken codes are standard for all equipment and are listed in all work unit code manuals. A complete list of authorized action taken codes is contained in AFM 300-4, volume XI.

(9) When Discovered Code. The when discovered code consists of one character and is used to identify when a defect or maintenance requirement was discovered, such as during a quality control inspection. When discovered codes are listed in each work unit code manual for individual types of equipment. A complete list of authorized when discovered codes is contained in AFM 300-4, volume XI. Only that portion of the when discovered code definition that applies to equipment listed in the work unit code manual is to be used. For example, when discovered code D, In-Flight-No Abort/During AGE Operation, would be listed in the AGE work unit code manual as D, During AGE Operation.

(10) How Malfunctioned Code. The how malfunctioned code consists of three characters and is used to identify how the equipment malfunctioned, such as cracked. To provide maximum utility, these codes are also used to identify time compliance technical order status requirements, or to show that a maintenance action did not result from a defect. A complete list of authorized how malfunctioned codes is contained in AFM 300-4, volume XI, in both alphabetical (definition) and numerical (code) sequence. Only those how malfunctioned codes that are applicable will be listed in each work unit code manual. For example, how malfunctioned codes applicable only to a solid rocket missile will not be listed in a ground CEM work unit code manual.

Note: Due to the nature of support type work, the recording of action taken, when discovered, and how malfunctioned codes is not required with support general work unit codes.

9-5. The foregoing paragraphs of this chapter describe the MDCS objectives and reporting concept as related to the base maintenance environment. In order to provide AFLC data on maintenance events as they occur worldwide, most of the data documented at AF bases under the TO 00-20-2 series are submitted to HQ AFLC for use in logistic support and related engineering decisions. These data are received and processed centrally at HQ AFLC in the DO56 Product Performance System. This data system not only receives and output reports containing Reliability and Maintainability (R and M) factors within its established computer programs but also services other interfacing data systems with source data. Some of the interfacing data systems also output reports containing R and M factors individually unique to their established computer program controls. Figures 9-1 through 9-18 illustrate the data flow from point of origin through the DO56 major system processes and to other interfacing systems which are driven by the same source data. The following pages of this chapter explain some of the terms used in the DO56 and samples of output reports containing R and M factors; however, for a full understanding of system capabilities refer to AFLCM 66-15 and 171-45.

9-6. Definitions of R and M parameters and terms used in the DO56 data system:

a. **Type How Malfunctioned Codes.**

(1) Type 1—These codes indicate that the item no longer can meet the minimum specified performance requirement due to its own internal failure pattern.

(2) Type 2—These codes indicate that the item can no longer meet the specified performance requirement due to some induced condition and not due to its own internal failure pattern.

(3) Type 6—These codes indicate maintenance resources were expended due to policy, modifications, items location, cannibalization and other no defect conditions existing at the time maintenance was accomplished.

b. **Failure occurrences.** The computer definition of a failure occurrence related to a Work Unit Code is: "any Type 1 How Malfunctioned code reported in combination with an action taken indicating repair, adjustment or item replacement and one or more units produced.

c. **Quantity per Application (QPA).** This is the quantity of identical installed items on a single unit of equipment that are reportable under the same work unit code.

MAINTENANCE DATA COLLECTION SYSTEM

REPORTING AT AF BASES

"ON" EQUIPMENT

Corrective and Preventive Maintenance at or on the Aircraft or Equipment

"OFF" EQUIPMENT

Corrective and Preventive Maintenance Accomplished in Repair Shops on Items Removed From Aircraft or Equipment

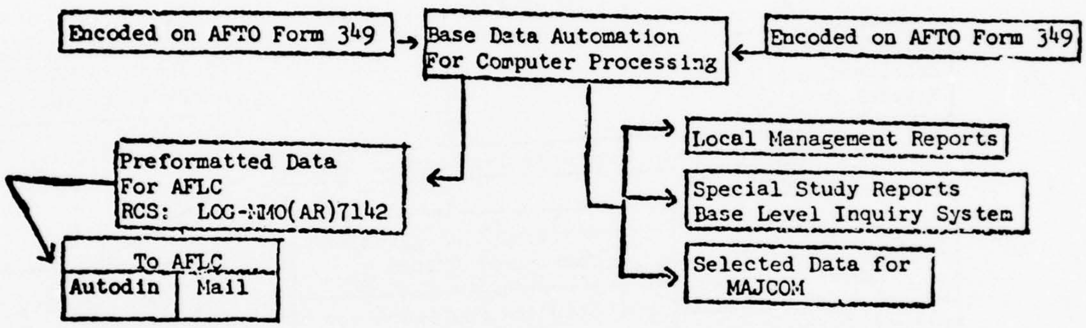

Figure 9-1

AFLC D056 WEEKLY COMPUTER PROCESSES

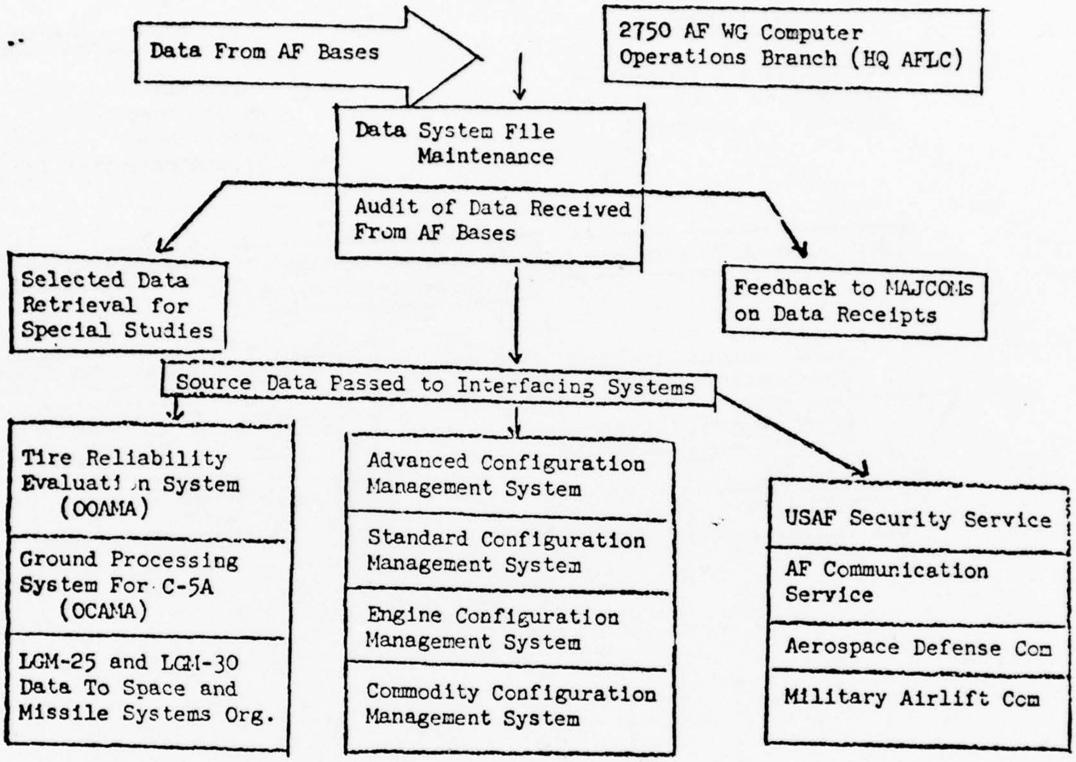

Figure 9-2

AFLC D056 MONTHLY COMPUTER PROCESSES

Data From D056 Weekly Processes

Source Data to Interfacing Systems

- Logistic Cost Ranking System Operating at Sacramento ALC
- Flight Safety Prediction Technique Operating at San Antonio ALC
- Analytical Interval Determination For Depot Level Maintenance
- Department of Defense Contractors

Data From Interfacing Systems

- Part Number to Stock Number Identification, Unit Price and AF Mgt Activity From Federal Cataloging System
- Identification of the Item Manager Technician and Division Within the AFLC Air Materiel Area
- Flying Hours, Inventory, Sorties and Landing From the Aircraft Status Reporting System
- Accident, Incident and Emergency Unsatisfactory Materiel Report Data From the AFLC AF Materiel Safety Office

D056 Output Reports

- D056 Data System Evaluation Reports
- Reports Designed for Evaluation of Hardware and Maintenance Performance Related to Individual Weapons and Equipment
- Reports Designed for Evaluation of Hardware and Maintenance Performance Related to Recoverable Items
- Precision Measurement Equipment Calibration Interval Analysis
- Selected Data Retrieval for Special Studies

Figure 9-3

d. Use Factor (K_1). This is a ratio of actual use time of individual Work Unit Codes to flying hours.

e. Mean Time Between Failure Occurrence (MTBF).

$$MTBF = \frac{\text{End Item Operating Time}^* \times K_1 \times QPA}{\text{Quantity of Failures}}$$

*End item operating time is determined as follows:

For aircraft—active aircraft inventory flying time from AFM 65-110.

For other equipment—Active inventory flying time from AFM 65-110.

f. Mean Time Between Maintenance Occurrence (MTBM).

$$MTBM = \frac{\text{End Item Operating Time}^* \times QPA}{\text{Quantity of Data Maintenance Occurrences}^*}$$

*All types of actions described in paragraph 9-6a.

g. Action Limit (AL). This is a form of failure limit expressed in MTBF (hours) and used in the computer program to compare current failure rates with past history for the same item.

h. Failure Limit. This is the acceptable quantity of failures of an item for a 30-day period. It is assigned by the system manager and used in the computer program to compare current period failures with past history for the same item.

9-7. DO56 OUTPUT REPORTS. Selected reports containing R and M related data are identified and briefly described in the following subparagraphs.

a. Selected Work Unit Code. Control Identifier, RCS: LOG-MMO(AR)7166. This report provides summarized information on Work Unit Codes within a weapon for the current reporting period that breeched either the Action Limit or Failure Limit; had Emergency Unsatisfactory Materiel Reporting; were high man-hour consumers or were high corrosion repair man-hour consumers. This report is used as a management reference to identify items that may warrant detail study and evaluation. Sample report Figure 9-4.

b. Detail Maintenance Actions for Selected Work Unit Codes, RCS: LOG-MMO(AR)7167. This report provides one to twelve months of "on" equipment information on Work Unit Codes within a weapon for detail studies. It is available only on special inquiry and can be limited in data presentation by selective retrieval options. (Sample Report Fig. 9-5.)

c. Detail Shop Actions for Selected Work Unit Codes, RCS: LOG-MMO(AR)7168. This report is a companion report to paragraph 9-7b and provides detail information from supporting repair shops on reparable items removed from a weapon. It also displays parts replaced during shop repair. (Sample Report Fig. 9-6.)

d. Summarized Maintenance Actions for Selected Work Unit Codes: RCS: LOG-MMO(AR)7169. This report provides the same type of information as described in paragraphs 9-7b and c but with lesser detail. It is produced when the Action or Failure Limit is breeched and also by special inquiry using selective retrieval routines. (Sample Report Fig. 9-7.)

e. Maintenance Actions, Man-hours and Aborts by Work Unit Code, RCS: LOG-MMO(AR)7170. This report provides six months of selected information by month on every reportable Work Unit Code assigned to a particular weapon or equipment. This information includes aborts, failures, maintenance actions, MTBF, MTBM and man-hours. Both "on" and "off" equipment data are considered for display in this report (except for some types of AGE, trainers and munitions). (Sample Report Fig. 9-8.)

f. Aborts and Degraded Alerts, RCS: LOG-MMO(AR)7171. This report provides current month detail information on Work Unit Codes and part numbers causing aborts, mission failures and degraded alerts. For ground equipment, this report identifies items causing equipment downtime. (Sample Report Fig. 9-9.)

g. Materiel Safety Deficiency Report, RCS: LOG-MMO(M)7178. This report provides twelve months of selected information for Work Unit Codes applicable to a Mission Design Series aircraft that have been reported as contributing to an accident or incident or have been the subject of an Emergency Unsatisfactory Materiel Report. Any of the above events having occurred within the past twelve months and recorded in the DO56 system, drives the computer to display failure rate, trending and predictive maintenance experience data in this report as well as the quantity of hazard conditions reported. (Sample Report Fig. 9-10.)

h. Work Unit Code Corrosion Summary, RCS: LOG-MMO(AR)7179. This report provides three months of information on a weapon or equipment identifying Work Unit Codes, number of units, man-hours and labor cost for corrective maintenance due to corrosion. The 25 Work Unit Codes incurring the highest corrosion repair cost are rank ordered and displayed separately in the report for ease of identification. (Sample Report Fig. 9-11.)

i. System, Subsystem Corrosion Summary, RCS: LOG-MMO(AR)7180. This report is produced as a comparison report to h above using the same three months of corrosion repair data except that the information is summarized to system/subsystem level and base location. (Sample Report Fig. 9-12.)

j. System, Subsystem, Work Unit Code Failure Summary, RCS: LOG-MMO(AR)7183. This report provides twelve months of information related to current quarter experience for systems, selected subsystems and Work Unit Codes on an aircraft. The data displayed is rank ordered by system, subsystem within system and Work Unit Code within subsystem based on the quantity of failures incurred. Information displayed includes the quantity of failures, MTBF, and a ratio of current quarter to the last twelve months experience. (Sample Report Fig. 9-13.)

k. Failure Rate Data for Selected Work Unit Codes, RCS: LOG-MMO(AR)7181. This report provides twelve months of information quarterly when the Action Limit is breeched and also by special in-

quiry using selective retrieval routines. Information displayed includes current quarter, previous quarter and 12-month MTBF, quarter to 12-month ratio and data groupings by when discovered, action taken, how malfunctioned and base location. (Sample Report Fig. 9-14.)

l. **Maintenance Man-hours per Flying Hour by Weapon, Command and System, RCS: LOG-MMO(AR)7185.** This report provides 12 months of information updated quarterly. The data displayed and the related computations are as indicated in the report title. (Sample Report Fig. 9-15.)

m. **Maintainability Reliability Summary, RCS: LOG-MMO(AR)7220.** This special inquiry report provides 12 months of information on Work Unit Codes within an aircraft. Information displayed includes failure, maintenance action, abort and man-hour rates as well as the most predominate malfunction modes. (Sample Report Fig. 9-16.)

n. **Selected Part Number Action Summary, RCS: LOG-MMO(AR)7188.** This report provides 12 months of information on a recoverable line item of supply (part number worldwide) regardless of its installed use environment. It is produced when the computed failure limit for an item (Federal Stock Number) is breeched and also by special inquiry. The information displayed does not reflect maintenance required while installed in a weapon or equipment. It is limited to "off" equipment (shop and depot) repairs. (Sample report Fig. 9-17.)

o. **Maintenance Actions for Selected FIIN Numbers, RCS: LOG-MMO(AR)7189.** This report provides six months of "off" equipment (shop and depot repair) information on a recoverable item. Information displayed includes quantities of maintenance actions, malfunction modes, and base location. It is produced when the computed failure limit for an item (Federal Stock Number) is breeched and also by special inquiry.

p. **Parts Replaced During Field or Depot Repair, RCS: LOG-MMO(AR)7190.** This report is produced on the same criteria as above displaying six months of parts replaced during repair of items identified in the RCS: LOG-MMO(AR)7189. Information also displays quantity and reason for replacement. (Sample report Fig. 9-18.)

TABLE OF CONTENTS

ACTION TAKEN CODES

CODE	DESCRIPTION
A	**BENCH CHECKED AND REPAIRED** THIS CODE WILL BE ENTERED WHEN BENCH CHECK AND REPAIR OF ANY ONE ITEM IS ACCOMPLISHED AT THE SAME TIME. (ALSO SEE CODE F.)
B	**BENCH CHECKED SERVICEABLE** (NO REPAIR REQUIRED) THIS CODE WILL BE ENTERED WHEN THE ITEM IS BENCH CHECKED AND NO REPAIR WAS REQUIRED.
C	**BENCH CHECKED-REPAIR DEFERRED** THIS CODE WILL BE ENTERED WHEN BENCH CHECK IS ACCOMPLISHED AND REPAIR ACTION IS DEFERRED. (SEE CODE F.)

ACTION TAKEN CODES

CODE	DESCRIPTION
A	**BENCH CHECKED AND REPAIRED** THIS CODE WILL BE ENTERED WHEN BENCH CHECK AND REPAIR OF ANY ONE ITEM IS ACCOMPLISHED AT THE SAME TIME. (ALSO SEE CODE F.)
B	**BENCH CHECKED SERVICEABLE** (NO REPAIR REQUIRED) THIS CODE WILL BE ENTERED WHEN THE ITEM IS BENCH CHECKED AND NO REPAIR WAS REQUIRED.
C	**BENCH CHECKED-REPAIR DEFERRED** THIS CODE WILL BE ENTERED WHEN BENCH CHECK IS ACCOMPLISHED AND REPAIR ACTION IS DEFERRED. (SEE CODE F.)

CODE	DESCRIPTION
D	**BENCH CHECKED-TRANSFERRED TO ANOTHER BASE OR UNIT** ITEM IS BENCH CHECKED AT A FORWARD OPERATING BASE, DISPERSED OPERATING BASE OR ENROUTE BASE AND IS FOUND UNSERVICEABLE AND TRANSFERRED TO A MAIN OPERATING BASE OR HOME BASE FOR REPAIR. THIS CODE WILL NOT BE USED FOR ITEMS RETURNED TO A DEPOT FOR OVERHAUL. THIS CODE WILL ALSO BE USED WHEN PME OR OTHER EQUIPMENT IS SENT TO ANOTHER BASE OR UNIT FOR BENCH CHECK, CALIBRATION, OR REPAIR AND IS TO BE RETURNED, AND FOR ITEMS FORWARDED TO CONTRACTORS ON BASE LEVEL CONTRACTS.
1	**BENCH CHECKED-NRTS (NOT REPAIRABLE THIS STATION REPAIR NOT AUTHORIZED)** THIS CODE WILL BE ENTERED WHEN THE SHOP IS NOT AUTHORIZED TO ACCOMPLISH THE REPAIR. THIS CODE SHALL ONLY BE USED WHEN THE REPAIR REQUIRED TO RETURN AN ITEM TO SERVICEABLE STATUS IS SPECIFICALLY PROHIBITED BY CURRENT TECHNICAL DIRECTIVES. THIS CODE SHALL NOT BE USED DUE TO LACK OF AUTHORITY FOR EQUIPMENT, TOOLS, FACILITIES, SKILLS, PARTS, OR TECHNICAL DATA.
2	**BENCH CHECKED-NRTS-LACK OF EQUIPMENT, TOOLS, OR FACILITIES** THIS CODE WILL BE ENTERED WHEN THE REPAIR IS AUTHORIZED BUT CANNOT BE ACCOMPLISHED DUE TO LACK OF EQUIPMENT, TOOLS, OR FACILITIES. THIS CODE SHALL BE USED WITHOUT REGARD AS TO WHETHER THE EQUIPMENT, TOOLS, OR FACILITIES ARE AUTHORIZED OR UNAUTHORIZED.
3	**BENCH CHECKED-NRTS-LACK OF TECHNICAL SKILLS** THIS CODE WILL BE ENTERED WHEN REPAIR CANNOT BE ACCOMPLISHED DUE TO LACK OF TECHNICALLY QUALIFIED PEOPLE.
4	**BENCH CHECKED-NRTS-LACK OF PARTS** THIS CODE WILL BE ENTERED WHEN PARTS ARE NOT AVAILABLE TO ACCOMPLISH REPAIR.
5	**BENCH CHECKED-NRTS-SHOP BACKLOG** THIS CODE WILL BE ENTERED WHEN REPAIR CANNOT BE ACCOMPLISHED DUE TO EXCESSIVE SHOP BACKLOG.
6	**BENCH CHECKED-NRTS-LACK OF TECHNICAL DATA** THIS CODE WILL BE ENTERED WHEN REPAIR CANNOT BE ACCOMPLISHED DUE TO LACK OF MAINTENANCE MANUALS, DRAWINGS, ETC. WHICH DESCRIBE DETAILED REPAIR PROCEDURES AND REQUIREMENTS.
7	**BENCH CHECKED-NRTS-EXCESS TO BASE REQUIREMENTS** THIS CODE WILL BE ENTERED WHEN REPAIR WILL NOT BE SCHEDULED FOR

ACTION TAKEN CODES (CONT)

CODE	DESCRIPTION (CONT)
7	**BENCH CHECKED NRTS EXCESS TO REQUIREMENTS (CONT)** SHOP REPAIR DUE TO ITEM BEING EXCESS TO BASE REQUIREMENTS
8	**BENCH CHECKED RETURNED TO DEPOT** RETURNED TO DEPOT BY DIRECTION OF SYSTEM MANAGER (SM) OR ITEM MANAGER (IM). USE ONLY WHEN ITEMS THAT ARE AUTHORIZED FOR BASE LEVEL REPAIR ARE DIRECTED TO BE RETURNED TO DEPOT FACILITIES BY SPECIFIC WRITTEN OR VERBAL COMMUNICATION FROM THE IM OR SM OR WHEN ITEMS ARE TO BE RETURNED TO DEPOT FACILITIES FOR MODIFICATION IN ACCORDANCE WITH A TIME COMPLIANCE TECHNICAL ORDER (TCTO) OR AS UR EXHIBITS
9	**BENCH CHECKED-CONDEMNED** THIS CODE WILL BE ENTERED WHEN THE ITEM CANNOT BE REPAIRED AND IS TO BE PROCESSED FOR CONDEMNATION, RECLAMATION, OR SALVAGE. THIS CODE WILL ALSO BE USED WHEN A "CONDEMNED" CONDITION IS DISCOVERED DURING FIELD MAINTENANCE DISASSEMBLY OR REPAIR.
E	**INITIAL INSTALLATION** THIS CODE WILL BE USED FOR INSTALLATION ACTIONS THAT ARE NOT RELATED TO A PREVIOUS REMOVAL ACTION SUCH AS INSTALLATION OF ADDITIONAL EQUIPMENT OR INSTALLATION OF AN ITEM TO REMEDY A SHIP-SHORT CONDITION. THIS CODE WILL BE USED ONLY FOR EQUIPMENT MANAGED UNDER THE ADVANCE CONFIGURATION MANAGEMENT SYSTEM. REFERENCE T.O.'S 00-20-2-3, 00-20-2-5, AND 00-20-2-7. MUST BE USED WITH HOW MAL CODE 799.
F	**REPAIR** THIS CODE WILL NOT BE USED TO CODE "ON EQUIPMENT" WORK IF ANOTHER CODE WILL APPLY. WHEN IT IS USED IN A SHOP ENVIRONMENT, THIS CODE WILL DENOTE REPAIR AS A SEPARATE UNIT OF WORK AFTER A BENCH CHECK. SHOP REPAIR INCLUDES THE TOTAL REPAIR MAN-HOURS AND INCLUDES CLEANING, DISASSEMBLY, INSPECTION, ADJUSTMENT, REASSEMBLY AND LUBRICATION OF MINOR COMPONENTS INCIDENT TO THE REPAIR WHEN THESE SERVICES ARE PERFORMED BY THE SAME WORK CENTER. FOR PRECISION MEASUREMENTS EQUIPMENT, THIS CODE WILL BE USED ONLY WHEN CALIBRATION OF THE REPAIRED ITEM IS REQUIRED (SEE CODE G).
G	**REPAIR AND/OR REPLACEMENT OF MINOR PARTS, HARDWARE AND SOFTGOODS** (SEALS, GASKETS, ELECTRICAL CONNECTORS, FITTINGS, TUBING, HOSE, WIRING, FASTENERS, VIBRATION ISOLATORS, BRACKETS, ETC.) WORK UNIT CODES DO NOT COVER MOST NON REPAIRABLE ITEMS. THEREFORE, WHEN ITEMS SUCH AS THOSE IDENTIFIED ABOVE ARE REPAIRED OR REPLACED, THIS ACTION TAKEN CODE WILL BE USED. WHEN THIS ACTION TAKEN CODE IS USED, THE WORK UNIT CODE WILL IDENTIFY THE ASSEMBLY BEING SERVICED OR MOST DIRECTLY RELATED TO PARTS BEING REPAIRED OR REPLACED. FOR EXAMPLE, IF AN ELECTRICAL CONNECTOR WAS REPAIRED AND WAS ATTACHED TO A RADIO TRANSMITTER, THE WORK UNIT CODE FOR THE TRANSMITTER WOULD BE USED WITH THIS ACTION TAKEN CODE. FOR PRECISION MEASUREMENT EQUIPMENT, THIS CODE WILL BE USED FOR REPAIRS THAT DO NOT REQUIRE CALIBRATION OF THE REPAIRED ITEM (SEE CODE F).

ACTION TAKEN CODES (CONT)

CODE	DESCRIPTION (CONT)
H	**EQUIPMENT CHECKED-NO REPAIR REQUIRED (FOR "ON EQUIPMENT" WORK ONLY)** THIS CODE WILL BE USED FOR ALL DISCREPANCIES WHICH ARE CHECKED AND FOUND TO REQUIRE NO FURTHER MAINTENANCE ACTION. THIS CODE WILL BE USED ONLY IF IT IS DEFINITELY DETERMINED THAT A REPORTED DEFICIENCY DOES NOT EXIST OR CANNOT BE DUPLICATED. MUST BE USED WITH HOW MAL CODE 799, 812, OR 948.
J	**CALIBRATED-NO ADJUSTMENT REQUIRED** USE THIS CODE WHEN AN ITEM IS CALIBRATED AND FOUND SERVICEABLE WITHOUT NEED FOR ADJUSTMENT, OR IS FOUND TO BE IN TOLERANCE BUT IS ADJUSTED MERELY TO PEAK OR MAXIMIZE THE READING. IF THE ITEM REQUIRES ADJUSTMENT TO ACTUALLY MEET CALIBRATION STANDARDS OR TO BRING IN TOLERANCE, USE CODE K.
K	**CALIBRATED-ADJUSTMENT REQUIRED** USE THIS CODE WHEN AN ITEM MUST BE ADJUSTED TO BRING IT IN TOLERANCE OR MEET CALIBRATION STANDARDS. IF THE ITEM WAS REPAIRED OR NEEDS REPAIR IN ADDITION TO CALIBRATION AND ADJUSTMENT, USE CODE F.
L	**ADJUST** INCLUDES ADJUSTMENTS NECESSARY FOR SAFETY AND PROPER FUNCTIONING OF EQUIPMENT SUCH AS ADJUST, BLEED, BALANCE, RIG, FIT, REROUTE, SEAT/RESEAT, POSITION/REPOSITION, OR ACTUATING RESET BUTTON, SWITCH OR CIRCUIT BREAKER. FOR USE WHEN A DISCREPANCY OR CONDITION IS CORRECTED BY THESE TYPES OF ACTIONS. IF THE IDENTIFIED COMPONENT OR ASSEMBLY ALSO REQUIRES REPLACEMENT OF BITS AND PIECES AS WELL AS ADJUSTMENT, ENTER THE APPROPRIATE REPAIR ACTION TAKEN CODE INSTEAD OF L.
M	**DISASSEMBLE** THIS CODE WILL BE ENTERED FOR DISASSEMBLY ACTION WHEN THE COMPLETE MAINTENANCE JOB IS BROKEN INTO PARTS AND REPORTED AS SUCH. DO NOT USE FOR ON EQUIPMENT WORK.
N	**ASSEMBLE** THIS CODE WILL BE ENTERED FOR ASSEMBLY ACTION WHEN THE COMPLETE MAINTENANCE JOB IS BROKEN INTO PARTS AND REPORTED AS SUCH. DO NOT USE FOR ON-EQUIPMENT WORK.
P	**REMOVED** THIS CODE WILL BE ENTERED WHEN AN ITEM IS REMOVED AND ONLY THE REMOVAL IS TO BE ACCOUNTED FOR. IN THIS INSTANCE DELAYED OR ADDITIONAL ACTIONS WILL BE ACCOUNTED FOR SEPARATELY. (ALSO SEE CODES Q, R, S, T, AND U.) DO NOT USE FOR OFF-EQUIPMENT WORK.
Q	**INSTALLED** THIS CODE WILL BE ENTERED WHEN AN ITEM IS INSTALLED AND ONLY THE INSTALLATION ACTION IS TO BE ACCOUNTED FOR. (ALSO SEE CODES E, P, R, S, T, AND U.) DO NOT USE FOR OFF-EQUIPMENT WORK.
R	**REMOVE AND REPLACE** THIS CODE WILL BE ENTERED WHEN AN ITEM IS REMOVED AND ANOTHER LIKE ITEM IS INSTALLED. (ALSO SEE CODES T AND U.) DO NOT USE FOR OFF-EQUIPMENT WORK.
S	**REMOVE AND REINSTALL** THIS CODE WILL BE ENTERED WHEN AN ITEM IS REMOVED AND THE SAME ITEM REINSTALLED. (ALSO SEE CODES T AND

ACTION TAKEN CODES (CONT)

CODE	DESCRIPTION (CONT)
S	**REMOVE AND REINSTALL (CONT)** U.) DO NOT USE FOR OFF-EQUIPMENT WORK. MUST BE USED WITH HOW MAL CODE 800, 804 OR 805.
T	**REMOVED FOR CANNIBALIZATION** THIS CODE WILL BE ENTERED WHEN A COMPONENT IS CANNIBALIZED. THE WORK UNIT CODE WILL IDENTIFY THE COMPONENT BEING CANNIBALIZED. DO NOT USE THIS CODE FOR OFF-EQUIPMENT WORK. MUST BE USED WITH HOW MAL CODE 799.
U	**REPLACED AFTER CANNIBALIZATION** THIS CODE WILL BE ENTERED WHEN A COMPONENT IS REPLACED AFTER CANNIBALIZATION. DO NOT USE THIS CODE FOR OFF-EQUIPMENT WORK. MUST BE USED WITH HOW MAL CODE 799.
V	**CLEAN** THIS CODE WILL BE ENTERED WHEN CLEANING IS ACCOMPLISHED TO CORRECT DISCREPANCY AND/OR WHEN CLEANING IS NOT ACCOUNTED FOR AS PART OF A REPAIR ACTION SUCH AS CODE F. INCLUDES WASHING, ACID BATH, BUFFING, SAND BLASTING, DEGREASING, DECONTAMINATION, ETC. CLEANING AND WASHING OF COMPLETE ITEMS SUCH AS GROUND EQUIPMENT, VEHICLES, MISSILES OR AIRPLANES SHOULD BE RECORDED BY UTILIZING SUPPORT GENERAL CODES.
X	**TEST-INSPECTION-SERVICE** THIS CODE WILL BE ENTERED WHEN AN ITEM IS TESTED OR INSPECTED OR SERVICED (OTHER THAN BENCH CHECK) AND NO REPAIR IS REQUIRED. THIS CODE DOES NOT INCLUDE SERVICING OR INSPECTION CHARGEABLE TO SUPPORT GENERAL WORK UNIT CODES.
Y	**TROUBLESHOOT** ENTER THIS CODE WHEN TIME EXPENDED IN LOCATING A DISCREPANCY IS GREAT ENOUGH TO WARRANT SEPARATING THE TROUBLESHOOT TIME FROM THE REPAIR TIME. USE OF THIS CODE NECESSITATES COMPLETION OF TWO SEPARATE LINE ENTRIES OR TWO SEPARATE FORMS, ONE FOR THE TROUBLESHOOT PHASE AND ONE FOR THE REPAIR PHASE. WHEN RECORDING THE TROUBLESHOOT TIME SEPARATE FROM THE REPAIR TIME, THE TOTAL TIME TAKEN TO ISOLATE THE PRIMARY CAUSE OF THE DISCREPANCY SHOULD BE RECORDED UTILIZING THE WORK UNIT CODE OF THE DEFECTIVE SUB-SYSTEM OR SYSTEM. DO NOT USE FOR OFF-EQUIPMENT WORK.
Z	**CORROSION REPAIR** INCLUDES CLEANING, TREATING, PRIMING AND PAINTING OF CORRODED ITEMS. THIS CODE SHOULD ALWAYS BE USED WHEN ACTUALLY TREATING CORRODED ITEMS EITHER ON EQUIPMENT OR IN THE SHOP. THE WORK UNIT CODE SHOULD IDENTIFY THE ITEM THAT IS CORRODED. USE SUPPORT GENERAL CODE FOR PAINTING OR CORROSION PREVENTIVE TREATMENT PRIOR TO AN ITEM BECOMING CORRODED.

CODE	TYPE MAINTENANCE CODES DESCRIPTION
**	TYPE MAINTENANCE CODES FOR AIRCRAFT, DRONES, INSTALLED ENGINES AND RELATED MOBILE TRAINING SETS (MTS) AND RESIDENT TRAINING EQUIPMENT (RTE). ENGINE SHOP CODES ARE INCLUDED FOLLOWING THIS LIST OF CODES.
A	**SERVICE** - INCLUDES ALL UNITS OF WORK ASSOCIATED WITH SERVICING, CLEANING AND MOVEMENT OF EQUIPMENT.
B	**UNSCHEDULED MAINTENANCE** - INCLUDES ALL UNITS OF WORK ACCOMPLISHED BETWEEN SCHEDULED INSPECTIONS EXCEPT AS PROVIDED IN PRECEDING CODE A, AND EXCLUDING ACCOMPLISHMENTS OF TCTO'S.
C	**BASIC POSTFLIGHT OR THRUFLIGHT INSPECTION** - INCLUDES ALL UNITS OF WORK ACCOMPLISHED DURING ALL PHASES OF THE BASIC POSTFLIGHT OR THRUFLIGHT INSPECTION.
D	**PREFLIGHT INSPECTION** - INCLUDES ALL UNITS OF WORK ACCOMPLISHED DURING ALL PHASES OF A PREFLIGHT INSPECTION. FOR MOBILE TRAINING SETS AND RESIDENT TRAINING EQUIPMENT THIS INCLUDES ALL UNITS OF WORK ACCOMPLISHED DURING SCHEDULED INSPECTIONS SUCH AS DAILY, SAFETY, AND SERVICING INSPECTION, EXCLUDING PERIODIC INSPECTIONS.
J	**CALIBRATION OF OPERATIONAL EQUIPMENT (NON PME) BY OWNING OR ASSISTING WORK CENTER** - EXCLUDES CALIBRATION ACTIONS BY PME CALIBRATING WORK CENTERS (SEE T.O. 00-25-06-4-1 FOR TYPE MAINTENANCE CODES FOR PME).
P	**PERIODIC, PHASED OR MAJOR INSPECTION** - INCLUDES ALL UNITS OF WORK ACCOMPLISHED DURING LOOK AND FIX PHASES OF PERIODIC, PHASED OR MAJOR INSPECTIONS, EXCLUDING ACCOMPLISHMENT OF TCTO'S.
Q	**FORWARD SUPPORT SPARES** - INCLUDES ALL UNITS OF WORK PERFORMED BY ALL ACTIVITIES IN RECORDING IN-SHOP MAINTENANCE ACTIONS ON MAC FORWARD SUPPORT SPARES, EXCLUDING ACCOMPLISHMENT OF TCTO'S.
R	**DEPOT MAINTENANCE** - INCLUDES ALL UNITS OF WORK ACCOMPLISHED WHEN DEPOT MAINTENANCE OR REHABILITATION IS PERFORMED, REGARDLESS OF LOCATION. EXCLUDES ACCOMPLISHMENT OF TCTO'S.
S	**SPECIAL INSPECTION** - INCLUDES ALL UNITS OF WORK ACCOMPLISHED DURING ALL PHASES OF SPECIAL INSPECTIONS, EXCLUDING ACCOMPLISHMENT OF TCTO'S. INCLUDES ALL FUNCTIONAL CHECK FLIGHTS.
T	**TIME COMPLIANCE TECHNICAL ORDER (TCTO)** - INCLUDES ACCOMPLISHMENT OF ALL TCTO'S.
Y	**AIRCRAFT TRANSIENT MAINTENANCE** - INCLUDES ALL UNITS OF WORK ACCOMPLISHED ON/OR FOR TRANSIENT AIRCRAFT, EXCLUDING ACCOMPLISHMENT OF TCTO'S.

NOTE

SEE T.O. 00-25-06-2-1 FOR OFF EQUIPMENT SHOP TYPE MAINTENANCE CODES.

CODE	WHEN DISCOVERED CODES DESCRIPTION
A	BEFORE FLIGHT - ABORT - AIR CREW.
B	BEFORE FLIGHT-NO ABORT-AIR CREW.
C	IN-FLIGHT ABORT.
D	IN-FLIGHT - NO ABORT
E	AFTER FLIGHT - AIR CREW.
F	BETWEEN FLIGHTS-GROUND CREW
G	GROUND ALERT - NOT DEGRADED
H	BASIC POSTFLIGHT INSPECTION
J	PREFLIGHT INSPECTION.
L	DURING TRAINING OR MAINTENANCE ON EQUIPMENT UTILIZED IN A TRAINING ENVIRONMENT (USE ONLY FOR CLASS II TRAINING EQUIPMENT). THIS CODE SHOULD BE USED WHEN RECORDING MAINTENANCE OR DISCREPANCIES ON CLASS II TRAINERS.
M	PHASED INSPECTION
N	GROUND ALERT - DEGRADED
P	FUNCTIONAL CHECK FLIGHT.
Q	SPECIAL INSPECTION.
R	QUALITY CONTROL CHECK.
S	DEPOT LEVEL MAINTENANCE.
T	DURING SCHEDULED CALIBRATION.
U	NON-DESTRUCTIVE INSPECTION. INCLUDES OPTICAL, PENETRANT, MAGNETIC PARTICLE, RADIOGRAPHIC, EDDY CURRENT, ULTRASONIC, SPECTROMETRIC OIL ANALYSIS, ETC.
V	DURING UNSCHEDULED CALIBRATION.
W	IN-SHOP REPAIR AND/OR DISASSEMBLY FOR MAINTENANCE.
X	ENGINE TEST STAND OPERATION.
Y	UPON RECEIPT OR WITHDRAWAL FROM SUPPLY STOCKS.
Z	DURING OPERATION OF MALFUNCTION ANALYSIS AND RECORDING EQUIPMENT OR SUBSEQUENT DATA ANALYSIS
4	CORROSION CONTROL INSPECTION.

Table B-1. How Malfunctioned Codes – Numerical Listing

001.... Gassy
003.... Open Filament or Tube Circuit
004.... Low GM or Emission
007.... Arcing, Arced
008.... Noisy
009.... Microphonic
010.... Poor or Incorrect Focus
020.... Worn, Chafed or Frayed
025.... Capacitance Incorrect
028.... Conductance Incorrect
029.... Current Incorrect
037.... Fluctuates, Unstable or Erratic
051.... Fails to Tune or Drifts
064.... Incorrect Modulation
065.... High Voltage Standing Wave Ratio
069.... Flame-Out
070.... Broken
080.... Burned Out or Defective Lamp, Meter or Indicating Device
086.... Improper Handling
088.... Incorrect Gain
092.... Mismatched - Wheel Halves, Electronic Parts, etc.
094.... No Gain or Emission
103.... Attack Display Malfunction
105.... Loose or Damaged Bolts, Nuts, Screws, Rivets, Fasteners, Clamps, or Other Common Hardware
106.... Missing Bolts, Nuts, Screws, Rivets, Fasteners, Clamps, or Other Common Hardware
108.... Broken, Faulty or Missing Safety Wire or Key
111.... Burst or Ruptured
116.... Cut
117.... Deteriorated
127.... Adjustment or Alignment Improper
130.... Change of Value
135.... Binding, Stuck or Jammed
142.... Engine Removed, Excessive Maintenance
150.... Chattering
158.... Launch Damage
160.... Contacts/Connection Defective
167.... Torque Incorrect
169.... Incorrect Voltage
170.... Corroded
177.... Fuel Flow Incorrect
181.... Compression Low
190.... Cracked
204.... Accidental Explosion of, or Damage from, Onboard Munitions
230.... Dirty, Contaminated or Saturated by Foreign Material
242.... Failed to Operate or Function - Specific Reason Unknown
246.... Improper or Faulty Maintenance
253.... Misfires
255.... No Output/Incorrect Output
277.... Fuel Nozzle Coking
279.... Spray Pattern Defective
290.... Fails Diagnostic/Automatic (RADAR) Test
300.... Grounded Electrically
301.... Foreign Object Damage
303.... Bird Strike Damage
314.... Slow Acceleration
315.... RPM Fluctuation or Incorrect
317.... Hot Start
330.... Excessive Hum
334.... Temperature Incorrect
350.... Insulation Breakdown
372.... Metal on Magnetic Plug
374.... Internal Failure
380.... Compressor Damaged - Reason Unknown
381.... Leaking - Internal or External
382.... Liquid Lock
383.... Lock on Malfunction
386.... Maintenance Action Due to Lost in Flight Occurrence
396.... Oil Breathing Excessive
398.... Oil Consumption Excessive
410.... Lack of, or Improper Lubrication
424.... External Power Source
425.... Nicked
447.... Wrong Logic
450.... Open
457.... Oscillating
458.... Out of Balance
464.... Overspeed
469.... Bushing Worn or Damaged
472.... Fuse Blown or Defective Circuit Protector
475.... Engine Failed to Start
481.... Keyway or Spline Damaged or Worn
486.... Turbine Damaged - Reason Unknown
503.... Sudden Stop
513.... Compressor Stall
518.... Improper Routing
520.... Pitted
525.... Pressure Incorrect
537.... Low Power or Thrust
540.... Punctured
553.... Does Not Meet Specification, Drawing, or Other Conformance Requirements (May only be used With When discovered Code Y)
561.... Unable to Adjust to Limits
567.... Resistance Incorrect
583.... Scope Presentation Incorrect or Faulty
585.... Sheared
598.... Auto Rotation RPM Incorrect (High/Low)
599.... Travel or Extension Incorrect
601.... Detonation
602.... Failed or Damaged Due to Malfunction of Associated Equipment or Item.
603.... Oil In Induction System
604.... Manifold Pressure Beyond Limits
605.... Crazed
606.... Counter Run Off-Position Indicator
607.... No-Go Indication - Specific Reason Unknown
615.... Shorted
617.... Sulfidation
619.... Shimmy Excessive
622.... Wet/Condensation
625.... Gating Incorrect
626.... Inductance Incorrect
627.... Attenuation Incorrect
629.... Relay Malfunction - Replacement Not Required
631.... Bias Voltage Incorrect
632.... Expended (Thermal Battery, Fire Extinguisher, Etc.)
635.... Sensitivity Incorrect
636.... Time Delay Incorrect
637.... Triggering Incorrect
649.... Sweep Malfunction
651.... Air in System
652.... Automatic Align Time Excessive
653.... Ground Speed Error Excessive
654.... Terminal Error - CEP Excessive
655.... Terminal Error - Range Excessive
656.... Terminal Error - Azimuth Excessive
657.... Distance Measurement Error-Navigation Equipment
658.... Bearing Destination (Station) Error
660.... Stripped
664.... Tension Incorrect
667.... Corroded, Severe
669.... Potting Material Melting (Reversion Process)
690.... Vibration Excessive
692.... Video Faulty
693.... Audio Faulty
694.... Audio and Video Faulty
695.... Sync Absent or Incorrect
697.... Faulty Tape - Program or Checkout
698.... Faulty Card - Program or Checkout
709.... Administrative Condemnation
710.... Bearing Failure or Faulty
711.... Improper Blanking
716.... Improper Response to Mechanical Input
719.... Broken or Frayed Bonding or Ground Wire
720.... Brush Failure/Worn Excessively
721.... Improper Response to Electrical Input
729.... Decoupled
730.... Loose
731.... Battle Damage
748.... Frequency Erratic or Incorrect
750.... Missing
770.... Slip Ring or Commutator Failure
780.... Bent, Buckled, Collapsed, Dented, Distorted or Twisted
782.... Tire Tread Area Defective - Use Cut, Delaminated, Punctured, Worn, etc., if applicable
783.... Tire Sidewall Damaged or Defective
784.... Tire Bead Area Damaged or Defective
785.... Tire Inside Surface Damaged or Defective
793.... No Defect - TCTO Kit Received by Base Supply or Parts Are Available in Supply
797.... No Defect - Technical Order Previously Complied With
798.... No Defect-Technical Order Not Applicable-Equipment to be Replaced, Modified or Not Installed
799.... No Defect
800.... No Defect - Component Removed and/or Reinstalled to Facilitate Other Maintenance
801.... No Defect - Technical Order Compliance
802.... No Defect - Partial Technical Order Compliance
803.... No Defect - Removed for Time Change
804.... No Defect - Removed for Scheduled Maintenance or Modification
805.... No Defect-Not Otherwise Coded Electrical, Hydraulic, Air, Fuel, Oxygen, Oil, etc., Lines, Mechanical Linkage and Cables Servicing a Component Removed Disconnected and/or Installed Connected to Facilitate Other Maintenance.
812.... No Defect-Indicated Defect Caused by Associated Equipment Malfunction
814.... Squib Blown
816.... Impedance Incorrect
[illegible].... Sync [illegible]
839.... B Plus Incorrect
846.... Delaminated
865.... Protective Coating Sealant Missing or Defective
877.... Transportation Damage
878.... Weather Damage
884.... Lead Broken
900.... Burned or Overheated
901.... Intermittent
910.... Chipped
911.... Technical Order Not Complied with - TCTO Complied with in Error or Placed in work in Error
916.... Impending or Incipient Failure Indicated by Spectrometric Oil Analysis
917.... Impending Failure or Latent Defect Indicated by Non-destructive Inspection (Do not use if other codes apply.)
931.... Accidental or Inadvertent Operation, Release or Activation (Use Code 386 if item was lost in flight)
932.... Does Not Engage, Lock or Unlock Correctly
935.... Scored or Scratched
937.... Overheated Cathode Stem
938.... Power Output Dip
939.... Unable to Load Program
941.... Nonprogrammed Halt
942.... Illegal Operation or Address
943.... Data Error
944.... Parity Error
946.... Incorrect or No Print Out
947.... Torn
948.... No Defect Operator Error
949 .... Computer Memory Error/Defect
955.... Data Link High Error Rate
956.... Abnormal Function of Computer Mechanical Equipment
957.... No Display
958.... Incorrect Display
959.... Fails to Transfer to Redundant Equipment
961.... High Anode Current
962.... Low Power - Electronic
963.... Broken Filament/Cathode Terminal
964.... Poor Spectrum
966.... RF Window Suckin, Broken or Cracked
968.... Dioding
969.... Cannot Resonate Input Cavity
970.... Coolant Leak
971.... Cracked Cathode Bushing
972.... Damaged Input Probe
973.... Damaged Output Probe
974.... Does Not Track Tuning Curve
975.... Filament to Cathode Short
981.... Frequency Instability
982.... Frozen Tuning Mechanism
983.... Grid to Cathode Short
984.... Grid to Plate Short
985.... High Body Current/Beam Interception
986.... High Modulator Inverse
987.... Input Pulse Distortion
988.... Loss of Vacuum
989.... Low Coolant Flow Rate
990.... No Focus Current
991.... Out of Band Frequency
992.... Output Pulse Distortion
993.... RF Drive Improper
994.... RF Feed-Thru Attenuated/Distorted
995.... RF Feed - Thru Completely Interrupted
996.... RF Terminal Overheated
997.... RF Window Burned

Table B-2. Typical Avionics Work Unit Codes for UHF Communications and Terrain Following Radar - F-111F

T.O. 1F-111F-06

WORK UNIT CODE	
63000	UHF COMMUNICATIONS
63AA0	RECEIVER-TRANSMITTER RT-749/ARC-109
63AAA	POWER SUPPLY 0635
63AAD	AMPLIFIER, RF, 0629
63AAE	MODULE, EXCITER, 0630
63AAF	TRANSLATOR, SIGNAL DATA, 0628
63AAG	SYNTHESIZER, ELECTRONIC FREQ, 0632
63AAJ	RECEIVER, RADIO-GUARD 0634
63AAL	AMPLIFIER, AF, 0633
63AAQ	MODULE, MODULATOR, 0631
63AAT	SUBASSY, RT 7900
63AAU	TUNER, RF 0636
63AAV	MODULE, DIGITAL DATA COMPARATOR 0637
63AAW	MOUNT MT-3322/ARC-109
63AA9	NOC
63AB0	CONTROL ARC-109
63AB9	NOC
	GENERAL
63ACA	ANTENNA SELECTOR C4809/ARC
63ACB	ANTENNA, UPPER
63ACC	ANTENNA, LOWER
63ACD	SWITCH, RF TRANSMITTER SA-521/A
63ACE	PANEL ASSY, ANTENNA SELECT
63AC9	NOC

T.O. 1F-111F-06

WORK UNIT CODE		
73000		BOMBING NAVIGATION
73K00		RADAR SET TERRAIN FOLLOWING
73KB0	•	ANTENNA-RECEIVER, AS-2136/APQ-128
73KBA		AMPLIFIER, DUAL IF
73KBB		AMPLIFIER, AUTOMATIC FREQUENCY CONTROL
73KBC		VIDEO PROCESSOR
73KBD		PHASE DETECTOR
73KBE		VIDEO SUBASSY, (PN 582946-1)
73KBH		SWITCH, WAVEGUIDE
73KBL		POWER SUPPLY, KLYSTRON
73KBM		OSCILLATOR, SELF-TEST
73KBN		ANTENNA ASSY
73KBP		RECEIVER DUPLEXER
73KBS		KLYSTRON & CONNECTOR ASSY
73KB9		NOC
73KC0	•	INDICATOR, TERRAIN FOLLOWING, IP-1012/APQ-134
73KCA		PANEL ASSY, FRONT
73KCC		INDICATOR ASSY NO. 1
73KCD		INDICATOR ASSY NO. 2
73KCE		INDICATOR ASSY NO. 3
73KCF		INDICATOR, AZIMUTH SERVO ASSY (4A)
73KCG		SELECTOR ASSY, RANGE
73KCH		SWEEP DRIVER AND VOLTAGE REGULATOR ASSY (A9)
73KCJ		FILTER ASSY
73KCK		ELECTRON TUBE AND DEFLECTION ASSY
73KCL		POWER SUPPLY, HIGH VOLTAGE
73KC9		NOC
73KD0	•	CONTROL, RADAR SET, C-7510/APQ-128
73KDA		RELAY ASSY
73KDB		DIODE ASSY
73KD9		NOC
73KE0	•	AMPLIFIER, POWER SUPPLY, AM-4915/APQ-128
73KEA		AMPLIFIER, ELEVATION
73KEB		AMPLIFIER, AZIMUTH
73KEC		PROGRAMMER, SCAN
73KED		POWER SUPPLY, PLUS 15 VDC
73KEE		POWER SUPPLY, MINUS 15 VDC
73KEF		SWITCH ASSY, POWER
73KEG		DIODE & CAPACITOR

T.O. 1F-111F-06

WORK UNIT CODE		
73000		BOMBING NAVIGATION
73KE0	•	AMPLIFIER, POWER SUPPLY, AM-4915/APQ-128 (CONT)
73KEH		SWITCH, STABILIZATION
73KEJ		AMPLIFIER, SCAN
73KEK		MONITOR, DRIFT
73KE9		NOC
73KF0	•	SYNCHRONIZER-TRANSMITTER SN-519/APQ-128
73KFA		SYNCHRONIZER ASSY
73KFB		MONITOR, POWER
73KFC		MODULATOR ASSY
73KF9		NOC
73KG0		EQUIPMENT RACK, ELECTRICAL
73KG9		NOC
73KH0		WAVEGUIDE ASSY
73KHA		WAVEGUIDE, UPPER
73KHB		WAVEGUIDE, LOWER
73KH9		NOC
73KK0		COMPUTER, TERRAIN FOLLOWING CP-917/APQ-128
73KKA		PANEL ASSY
73KKB		GENERATOR, RANGE
73KKC		GENERATOR, TEMPLATE
73KKD		COMPUTER, FLIGHT VECTOR
73KKE		MONITOR, INPUT SIGNAL
73KKF		GENERATOR, AURAL COMMAND
73KKG		CONVERTER, SYN ANALOG
73KKH		DRIVER, SELF-TEST
73KKJ		GENERATOR, TEST SEQUENCE
73KKK		MONITOR, SELF-TEST
73KKL		PEAK DETECTOR
73KKM		ALTIMETER OVERIDE
73KKN		DEMODULATOR, STICK POSITION
73KK9		NOC
73V00		ATTACK RADAR AN/APQ-144
73VA0	•	RECEIVER TRANSMITTER MODULATOR MD-843
73VAA		MODULATOR ASSY
73VAB		TRIGGER ASSY
73VAC		OVERLOAD 1 ASSY
73VAD		REGULATOR, ENERGY A
73VAE		FILTER, 3 PHASE RECTIFIER
73VAF		SWITCHING ASSY, LOGIC
73VAG		RECTIFIER ASSY, S1
73VAH		MAGNETRON ASSY
73VAJ		AMPLIFIER, ELECTRONIC CONTROL

APPENDIX C

Average Number of Maintenance Actions per Sortie versus Sortie Length for Selected Systems

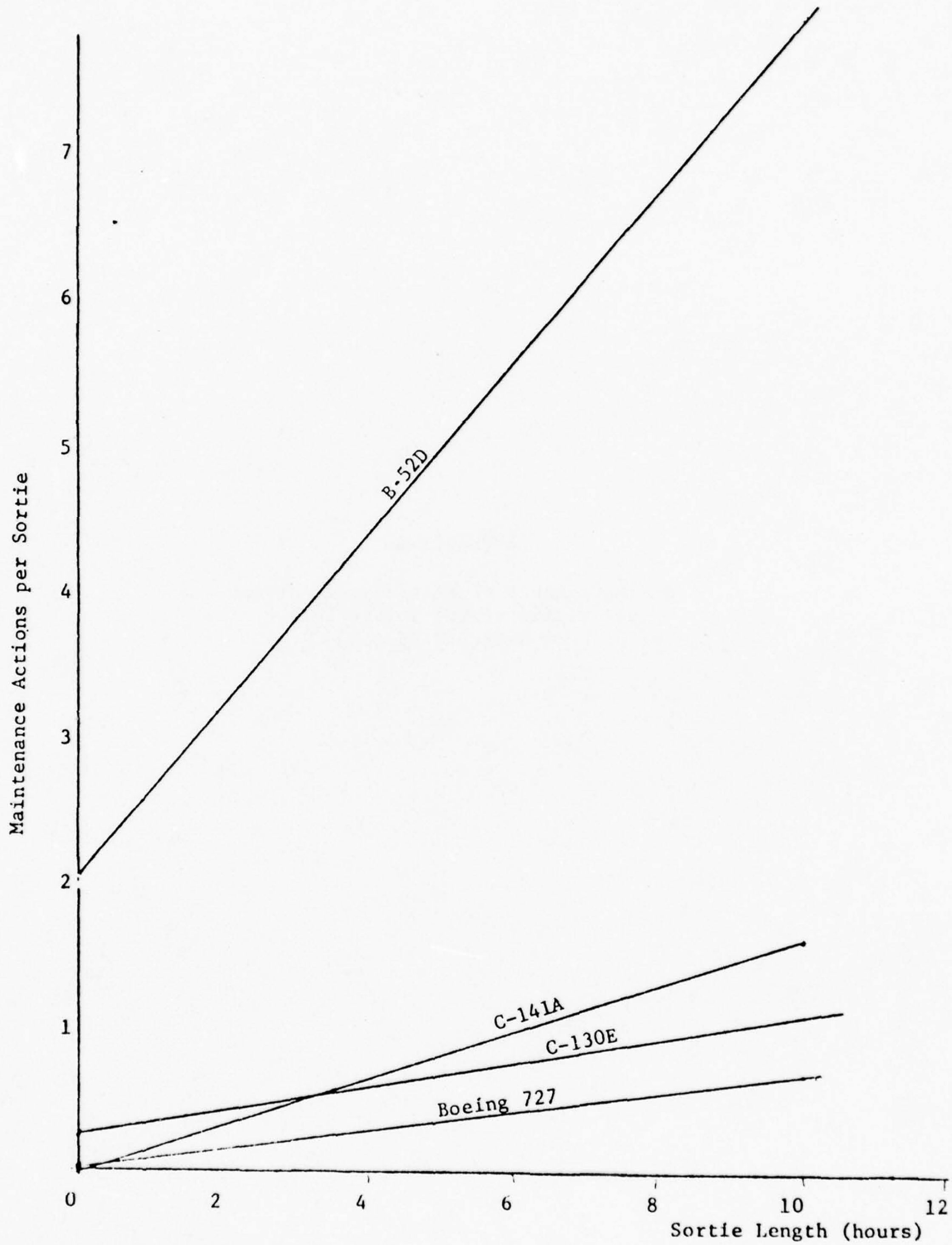

Figure C-1. System 11- Airframe

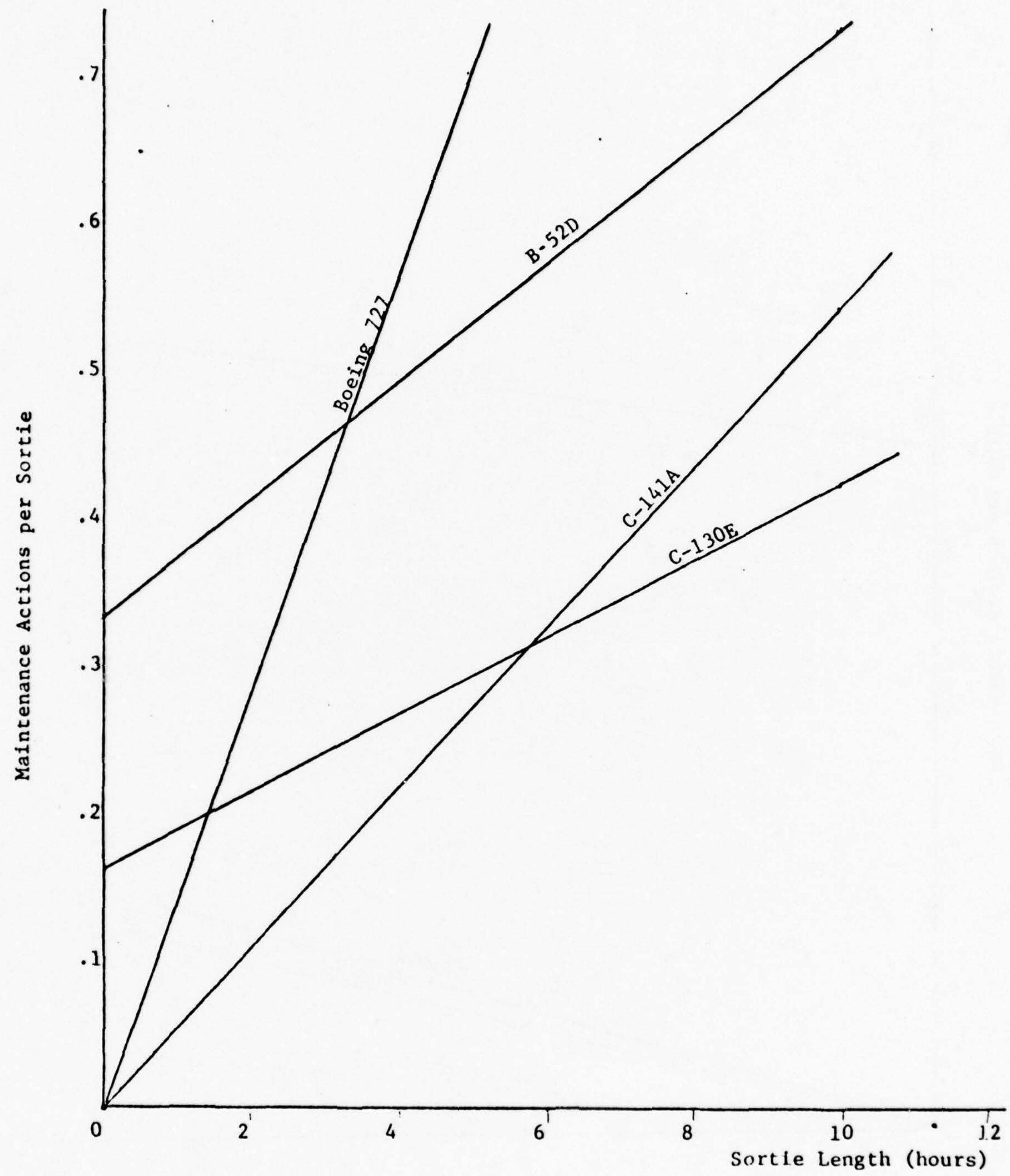

Figure C-2. System 12 - Fuselage Compartments

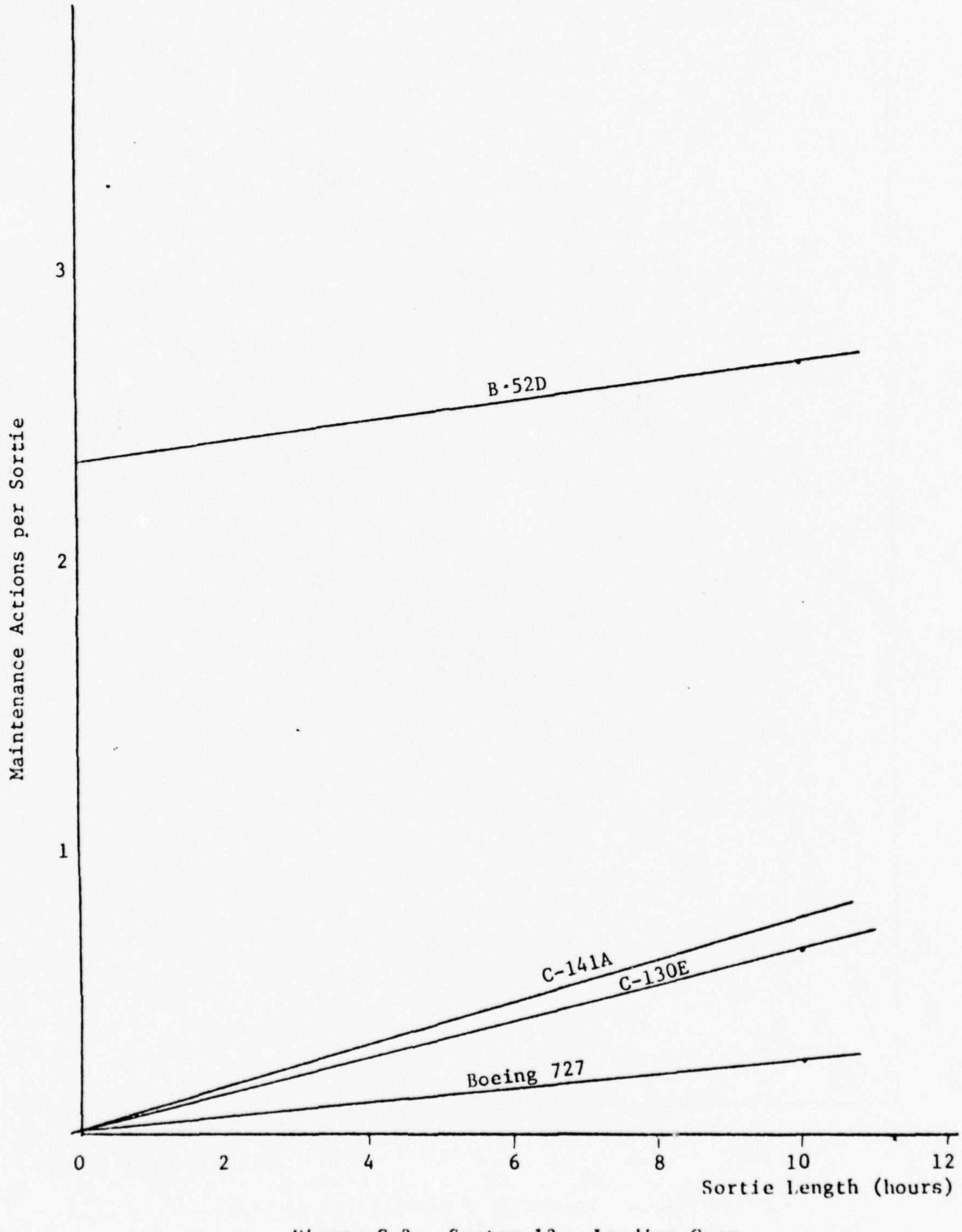

Figure C-3. System 13 - Landing Gear

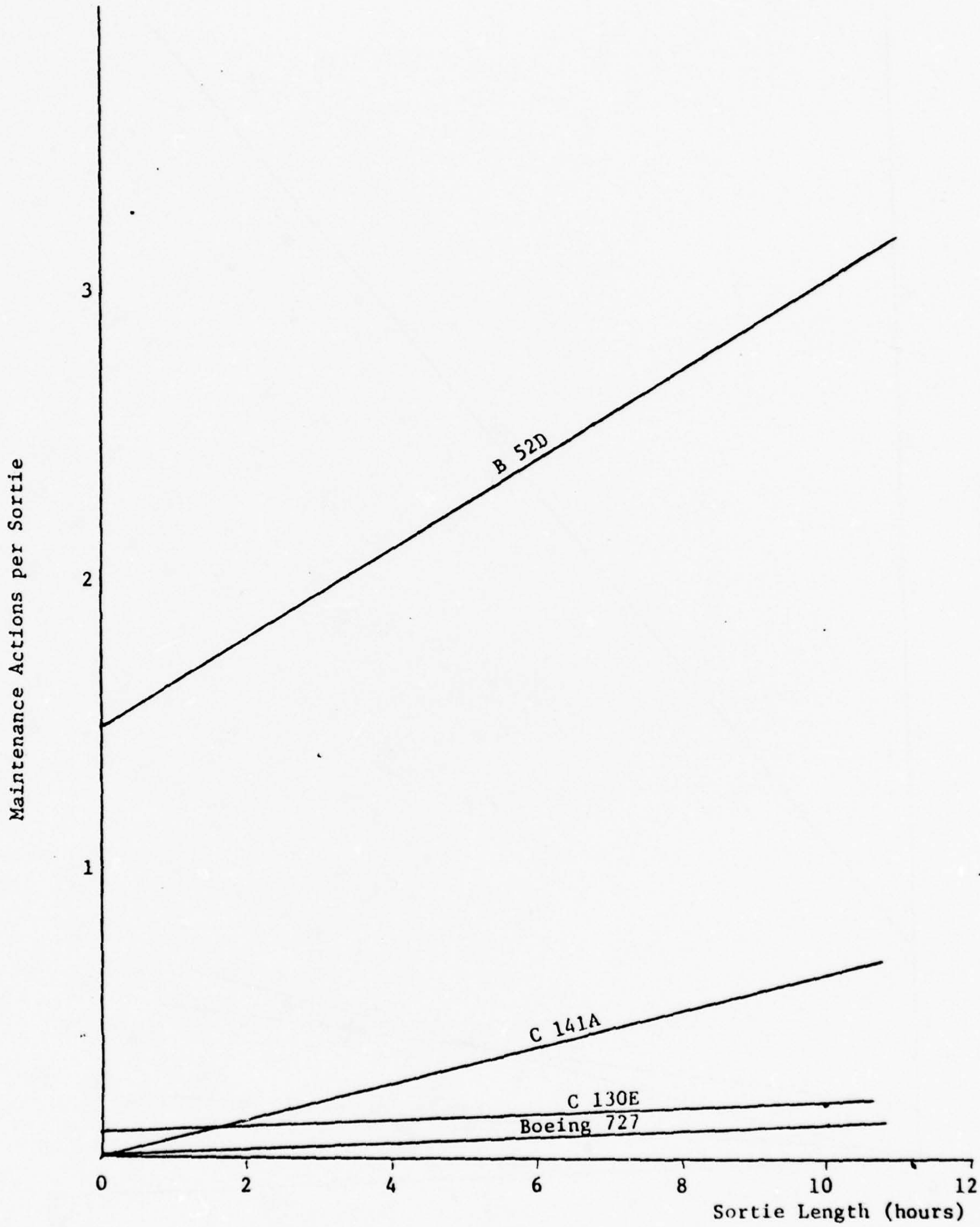

Figure C-4. System 14 - Flight Controls

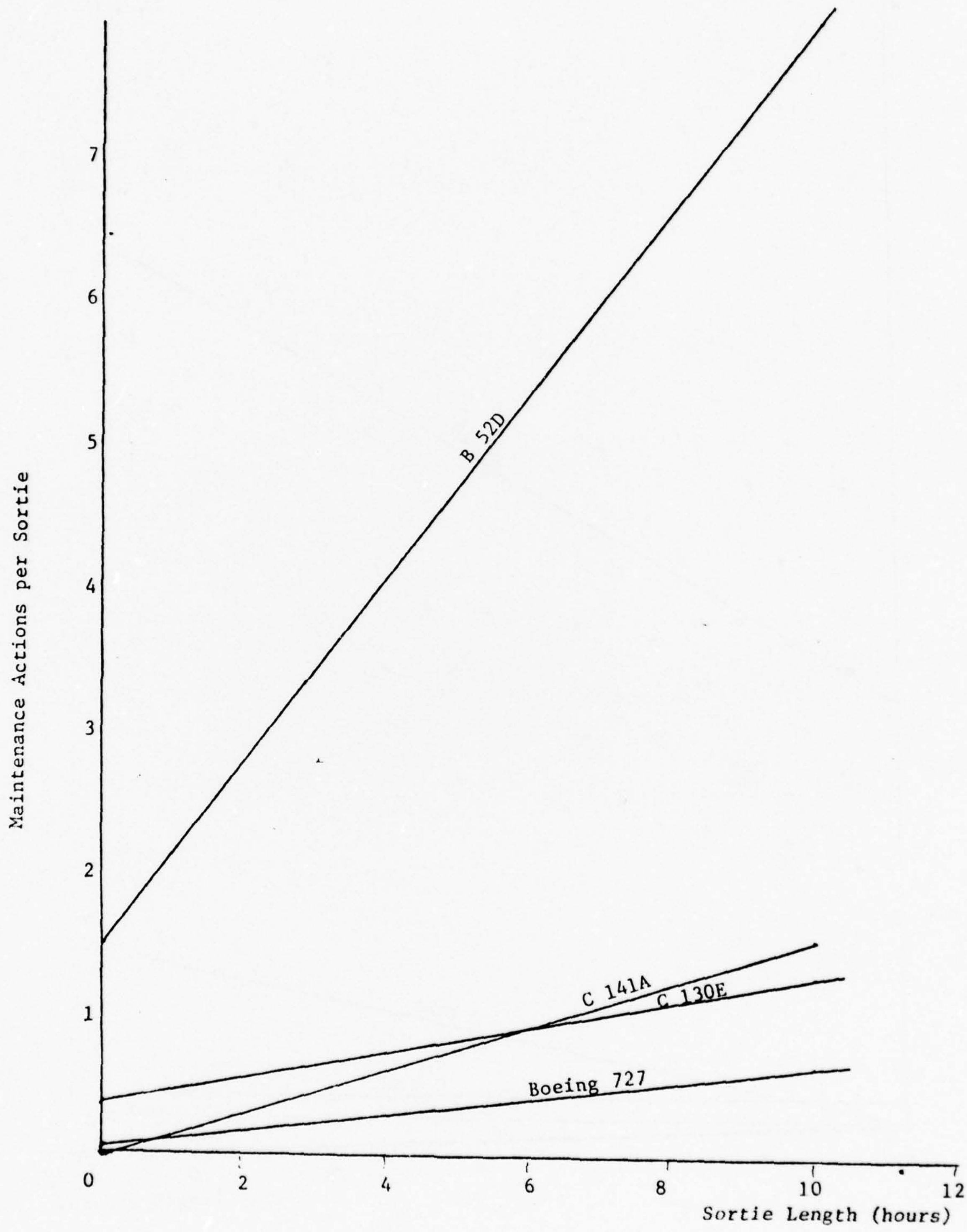

Figure C-5. System 22/23 - Engine

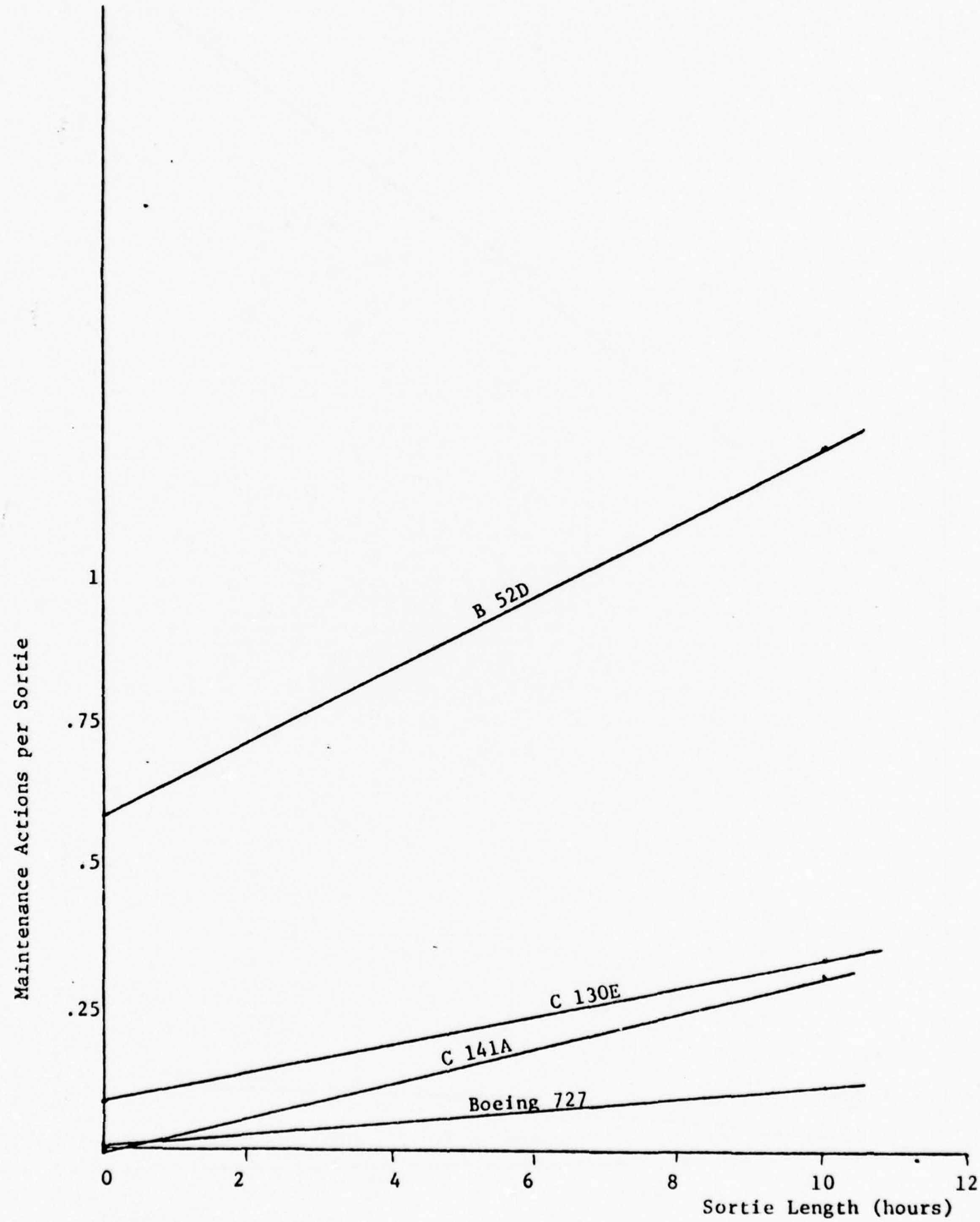

Figure C-6. System 41 - Air Cond

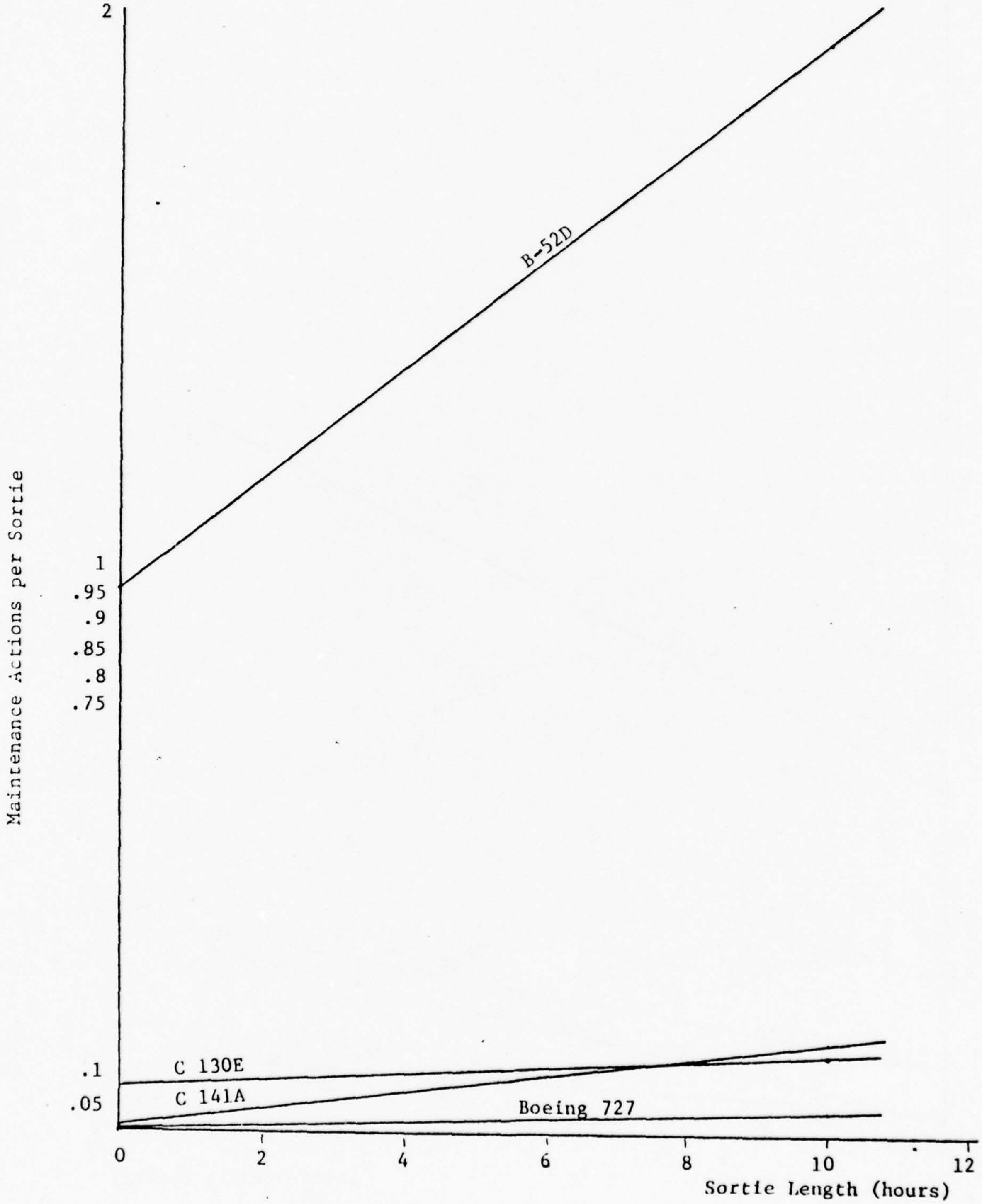

Figure C-7. System 42 - Electrical Power Supply

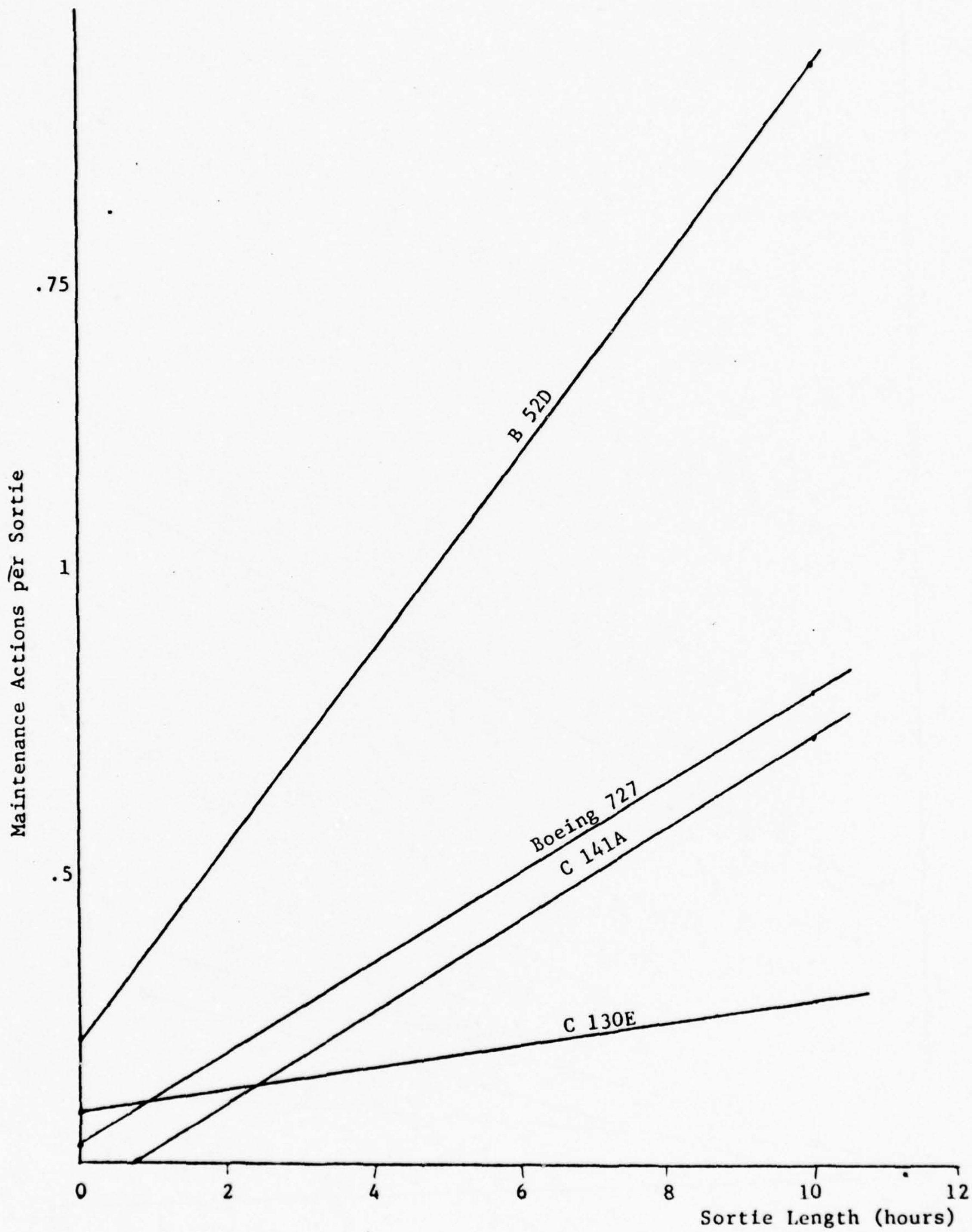

Figure C-8. System 44 - Lighting Systems

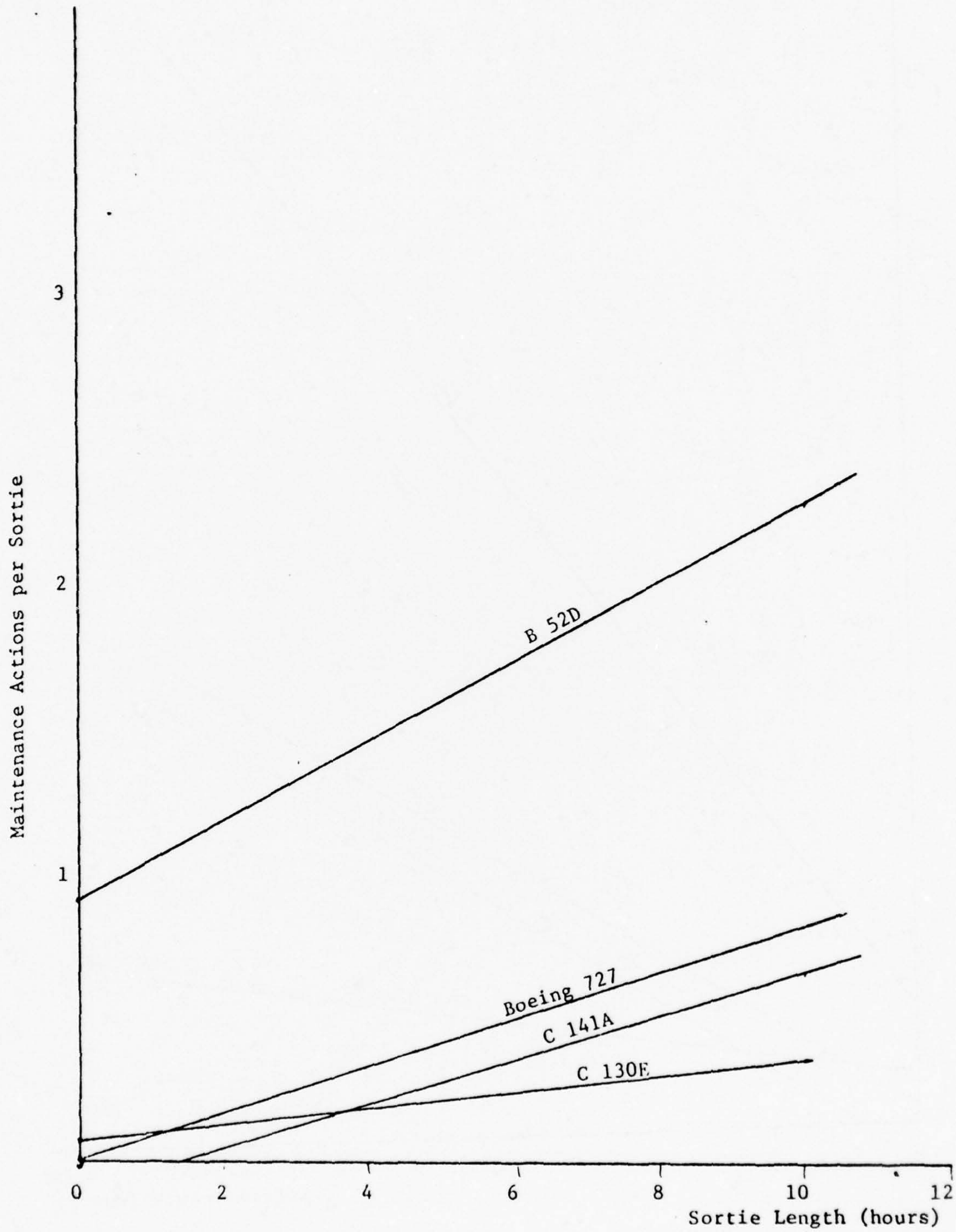

Figure C-9. System 45 - Hydraulic & Pneumatic Sys

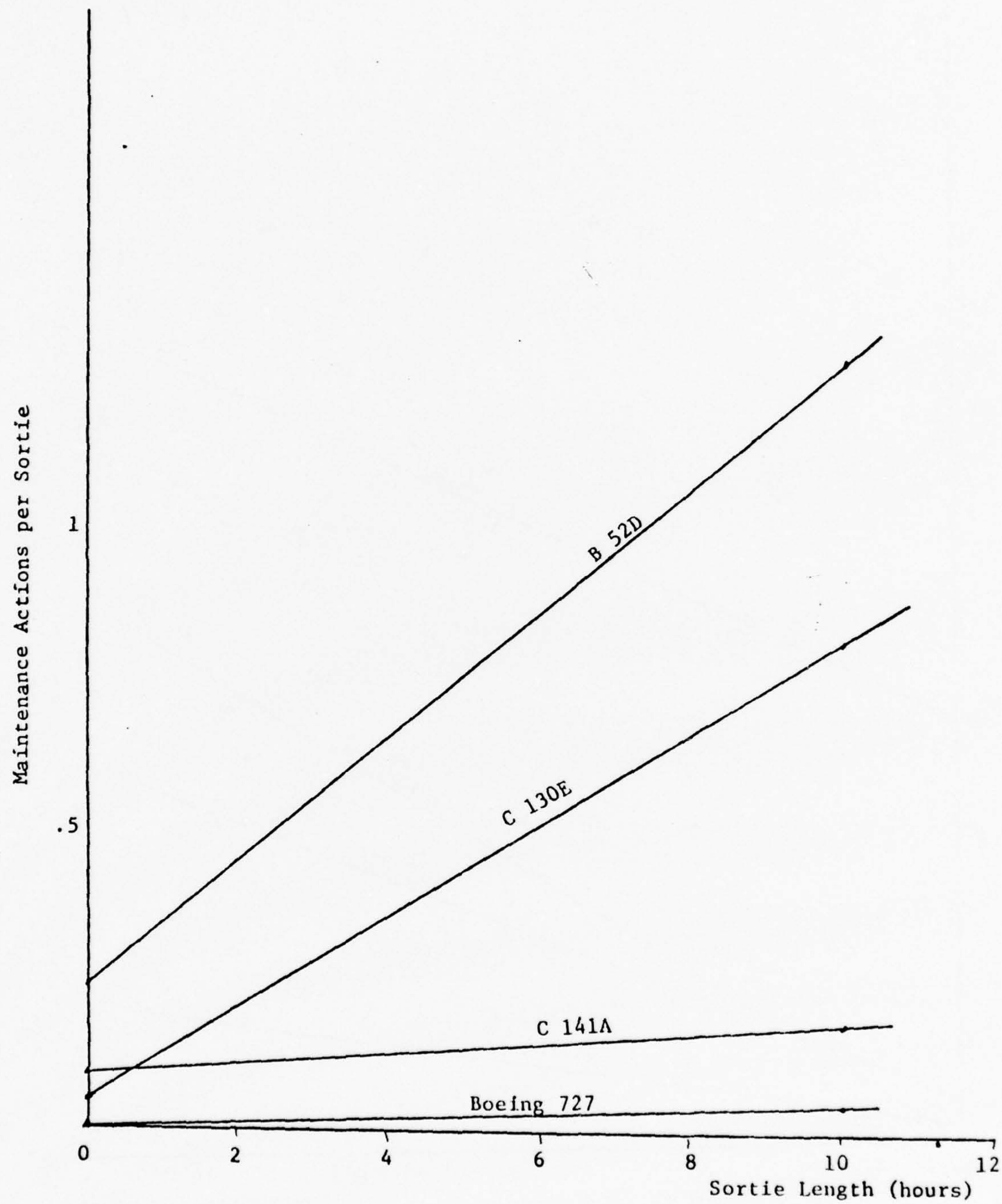

Figure C-10. System 46 - Fuel Systems

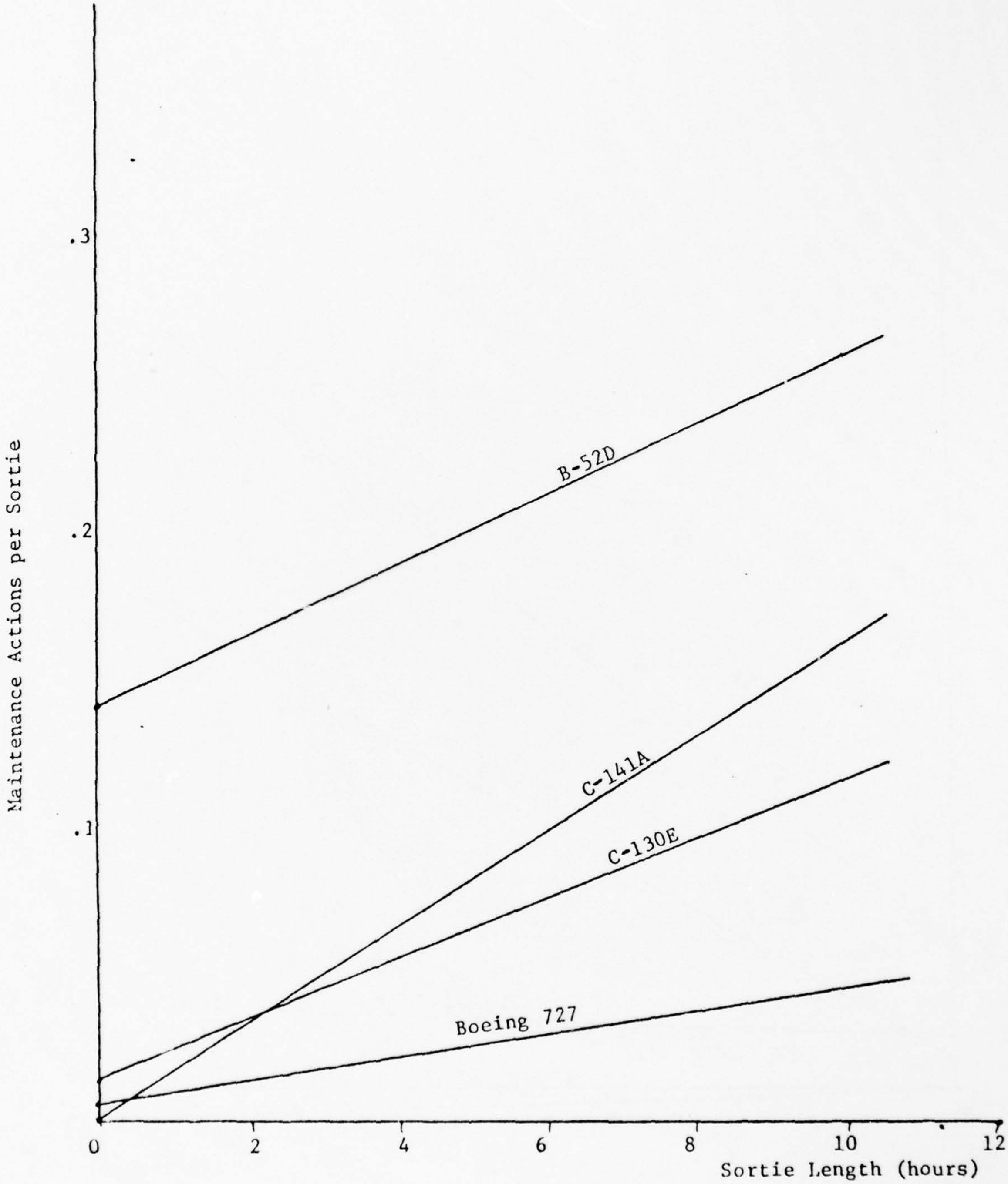

Figure C-11. System 47 - Oxygen Supply

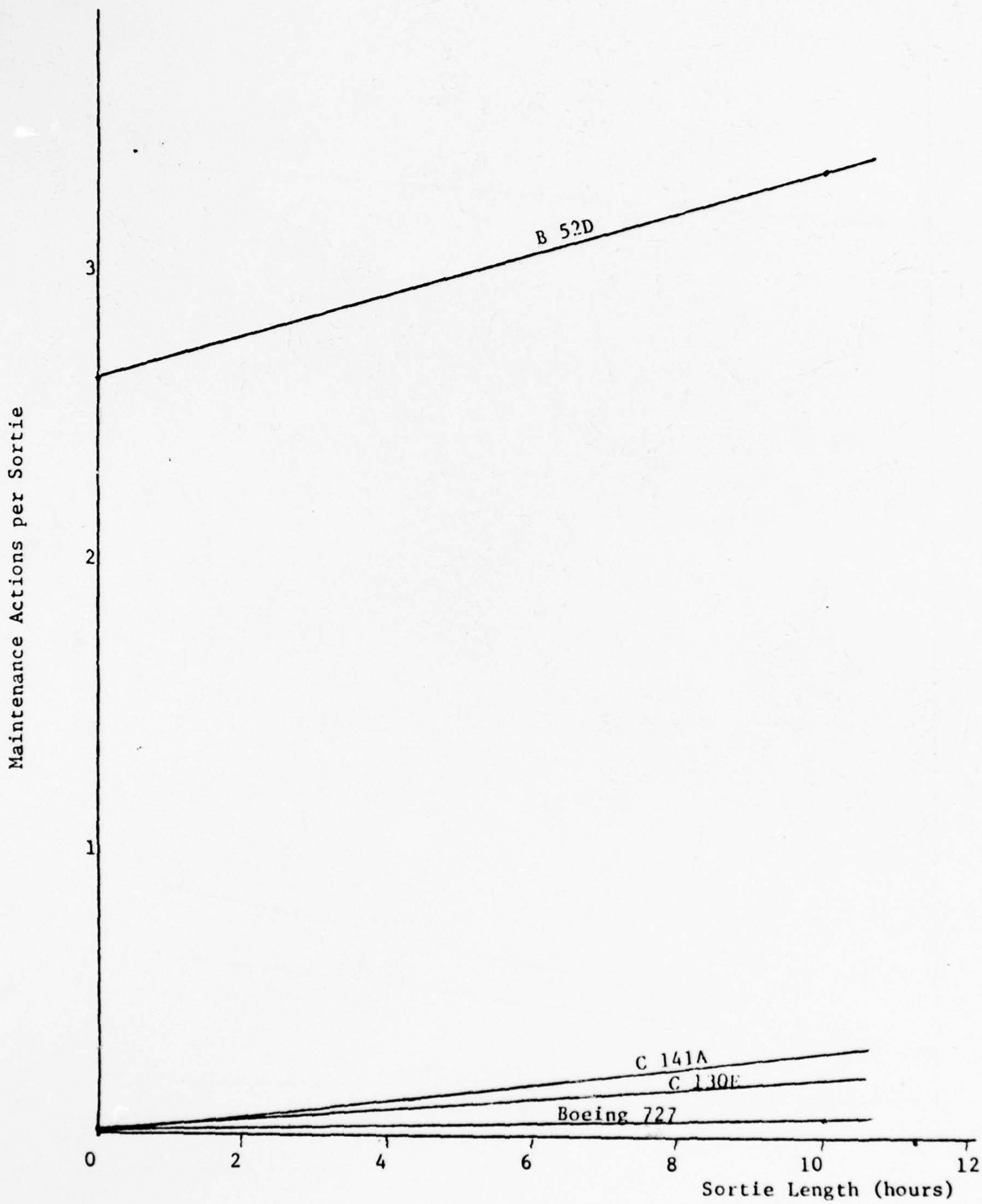

Figure C-12. System 51 - Instruments

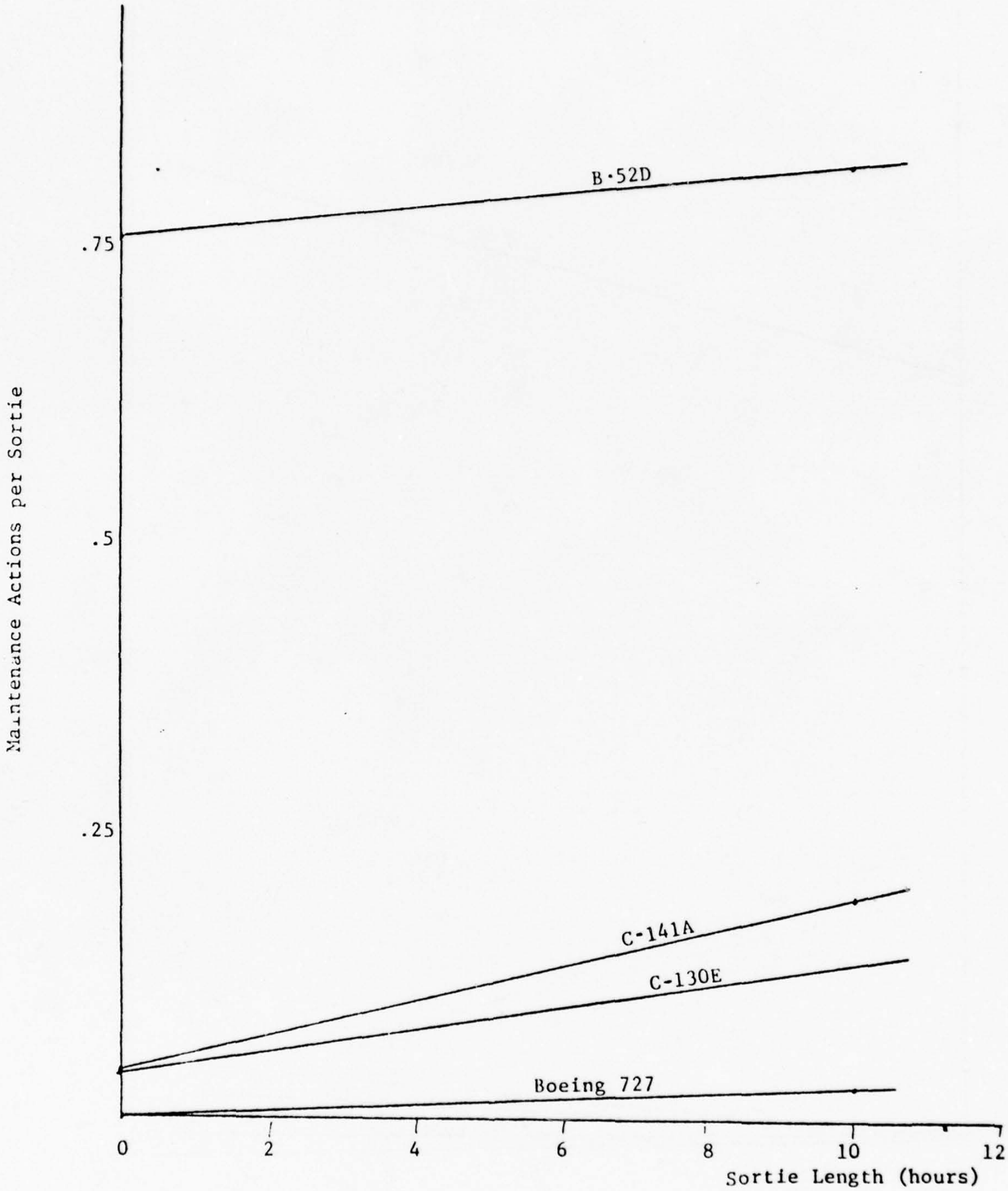

Figure C-13. System 52 - Autopilot

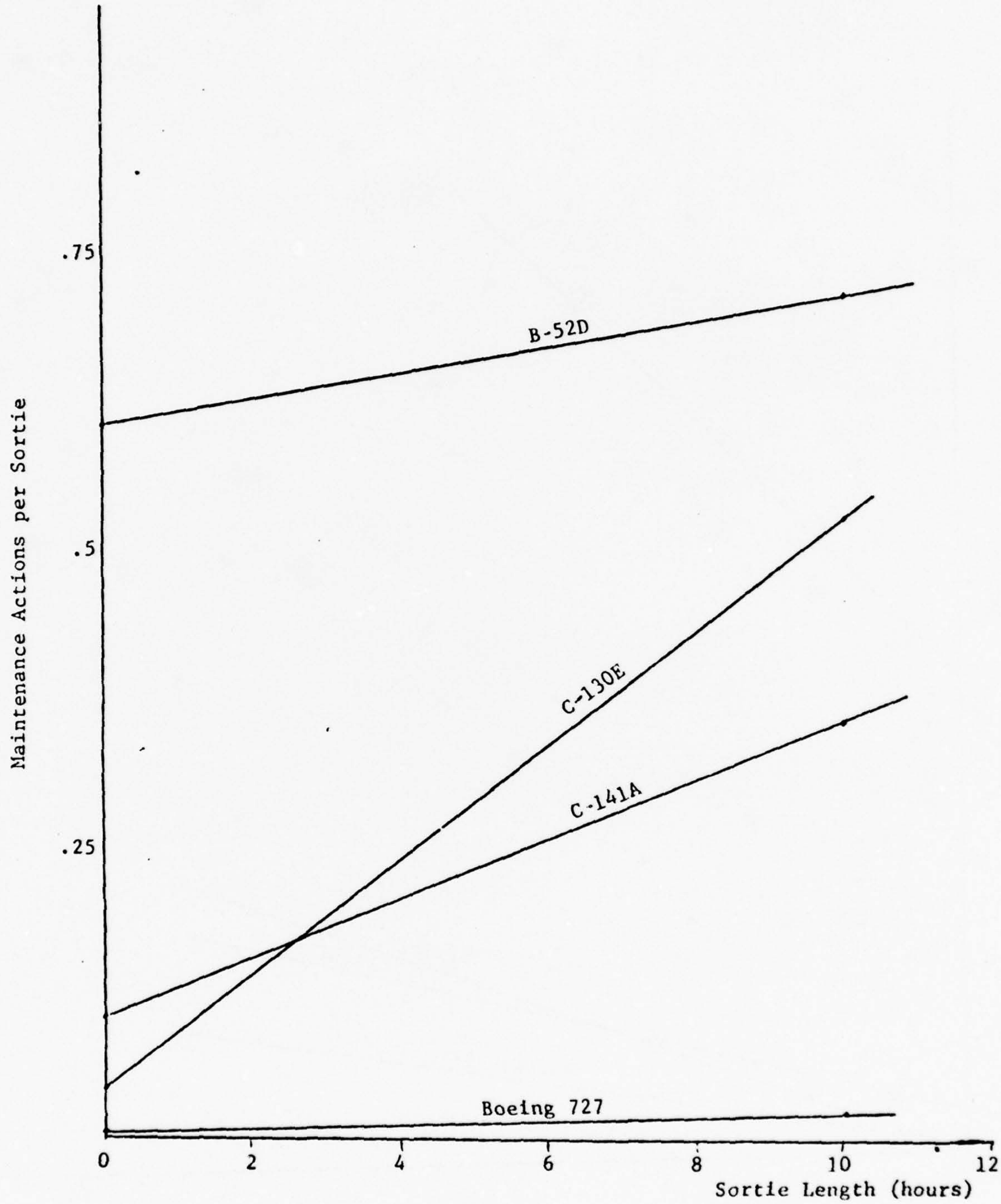

Figure C-14. System 61/64 - Communications

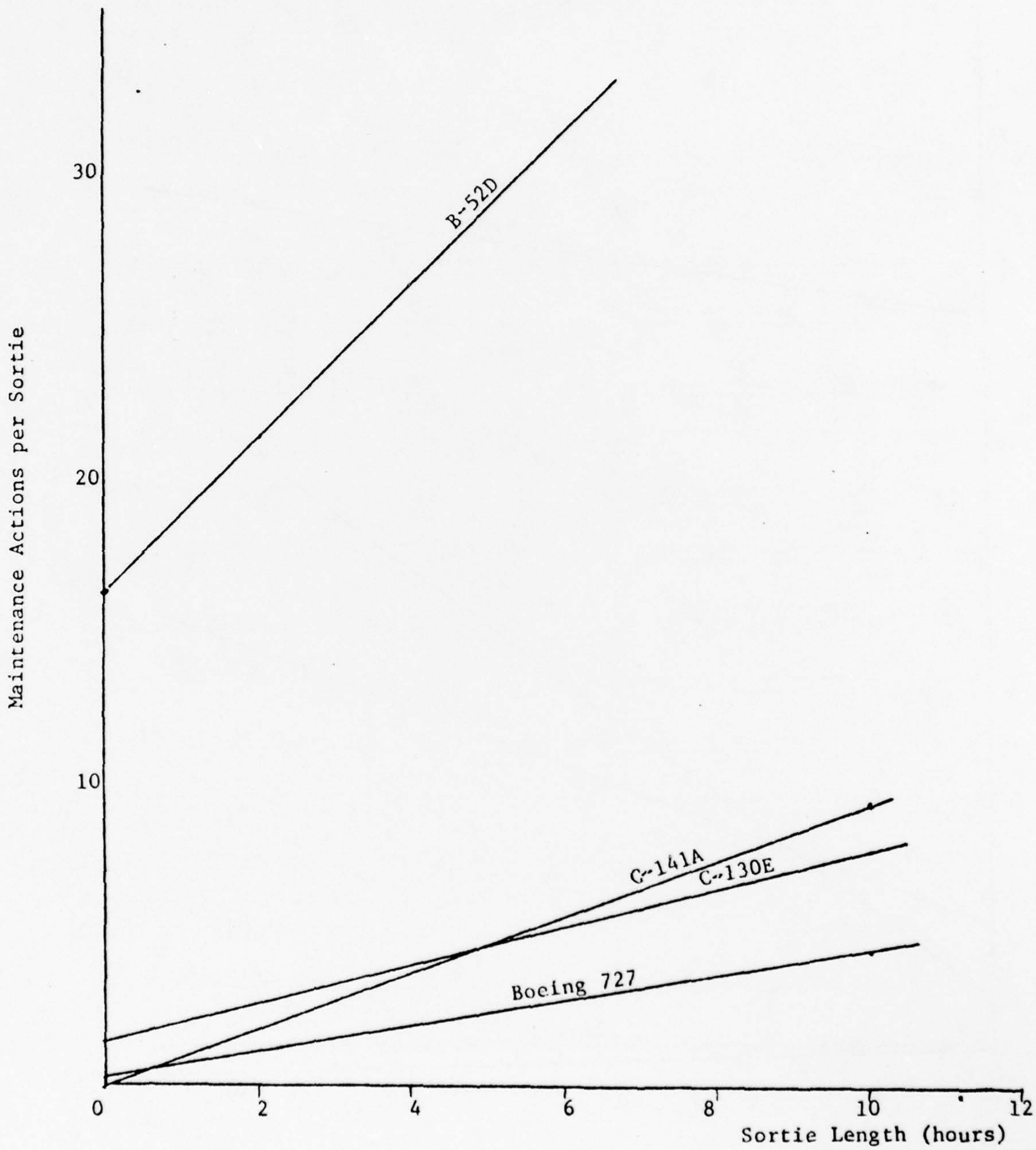

Figure C-15. All Maintenance

APPENDIX D

C-130E and C-141A Maintenance Data
and Flight Statistics

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   19:54 SUNDAY, MAY 21, 1978   1

OBS	PLANE	X11	X12	X13	X14	X22	X24	X41	X42	X44	X45	X46	X47	X49	X51	X52	X61	X65	X71	X72	HRS	SORT	MO	GRP
1	495	144	76	44	28	153	16	59	25	34	52	57	6	25	23	14	42	6	43	90	769.0	268	12	1
2	496	83	79	33	25	104	27	29	34	26	35	25	8	30	24	15	65	5	29	55	443.9	151	10	1
3	497	121	59	37	35	133	5	63	10	24	32	21	20	8	15	16	37	22	34	45	465.3	193	11	7
4	498	144	80	55	29	146	14	33	34	26	51	78	11	24	22	20	67	10	29	81	538.2	191	12	1
5	499	101	54	43	43	137	13	41	20	45	48	49	4	20	35	42	56	1	44	119	549.5	201	11	1
6	500	72	41	23	21	40	11	27	14	12	23	63	9	12	9	10	36	3	24	51	747.7	240	12	3
7	501	118	48	32	36	139	23	38	26	29	32	47	6	27	17	17	43	6	34	56	423.3	158	11	1
8	502	200	53	54	34	124	14	56	37	49	67	85	20	33	28	27	43	8	38	64	497.8	194	11	1
9	503	110	113	38	33	150	18	30	14	28	32	42	19	18	20	11	51	3	13	58	596.9	158	12	7
10	504	69	29	41	14	76	12	19	7	32	19	53	9	5	16	30	28	17	11	53	508.9	155	10	17
11	510	75	22	41	17	89	13	40	16	35	24	78	8	11	29	20	38	11	33	52	660.1	258	12	17
12	512	64	37	50	20	48	20	41	3	27	10	44	11	17	24	15	31	8	46	55	492.7	140	11	17
13	513	68	43	31	25	83	16	28	8	43	36	83	7	16	29	20	59	3	28	73	701.5	185	12	17
14	514	129	71	46	36	138	19	37	23	29	24	54	10	23	21	53	52	7	40	79	647.6	206	12	7
15	515	164	99	44	42	176	19	59	6	58	26	34	20	17	21	29	22	0	23	56	510.2	161	12	7
16	517	171	44	35	29	147	31	43	28	38	46	68	10	14	31	10	42	15	39	107	793.6	281	12	1
17	518	124	58	38	26	162	19	40	19	24	31	21	18	14	14	21	53	3	24	67	639.1	271	12	7
18	519	56	39	65	22	104	21	45	11	41	29	85	13	17	14	25	45	5	43	74	754.5	230	12	17
19	520	165	186	55	37	202	23	63	14	36	47	23	12	13	21	8	46	2	31	53	700.8	250	12	7
20	521	73	33	61	34	96	5	42	14	34	35	67	10	13	23	29	42	3	34	54	462.6	136	11	17
21	524	57	30	45	15	41	13	28	8	19	13	55	5	6	13	11	59	2	24	47	476.5	164	11	17
22	525	94	64	35	23	126	28	61	19	35	49	57	16	28	29	33	41	3	22	71	598.7	262	12	1
23	526	71	62	45	11	96	6	11	18	39	23	18	10	16	17	21	38	1	36	58	733.6	153	12	3
24	527	106	45	26	36	129	23	32	18	24	29	86	9	30	20	28	41	2	11	62	389.8	161	11	1
25	529	123	70	39	24	130	26	29	29	28	44	67	7	30	23	14	51	3	18	62	390.8	156	10	1

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   19:54 SUNDAY, MAY 21, 1978   2

OBS	PLANE	X11	X12	X13	X14	X22	X24	X41	X42	X44	X45	X46	X47	X49	X51	X52	X61	X65	X71	X72	HRS	SORT	MO	GRP
26	530	54	26	33	13	70	12	27	12	14	27	55	3	4	13	4	29	2	25	60	611.4	135	12	3
27	531	208	51	48	59	159	21	47	45	44	40	79	10	26	36	17	39	7	40	77	521.4	210	11	.
28	532	64	60	30	11	74	4	16	13	25	20	32	3	9	14	20	24	25	23	58	604.7	134	12	.
29	533	65	34	44	23	83	15	16	14	24	31	63	6	6	10	4	28	0	39	46	658.9	138	12	3
30	534	89	75	32	14	119	26	27	13	23	40	24	6	11	21	24	35	4	18	41	534.7	211	12	7
31	535	83	49	30	25	102	11	32	16	20	16	40	4	8	10	13	35	2	20	60	638.2	139	11	3
32	537	132	68	45	30	145	17	37	29	30	37	36	15	21	36	16	62	3	22	48	619.6	262	11	1
33	538	46	21	27	15	72	8	14	15	19	20	38	5	15	14	10	19	1	24	49	504.0	112	10	3
34	539	71	46	34	14	90	7	31	21	30	14	46	10	11	8	15	12	6	16	47	434.0	94	11	3
35	540	180	66	57	53	115	28	33	47	38	42	82	16	36	31	18	42	6	34	81	390.1	140	11	1
36	541	99	35	36	17	133	9	27	16	33	27	48	12	9	25	15	41	0	19	61	662.8	197	12	3
37	542	68	33	19	16	66	11	23	14	26	16	46	15	7	10	10	25	1	17	33	550.1	148	10	4
38	543	64	31	19	16	90	14	14	11	14	22	45	6	11	4	10	55	3	32	60	475.1	154	11	16
39	544	125	75	33	24	110	16	37	18	27	26	29	17	15	17	23	41	0	24	75	420.0	157	11	7
40	549	40	19	21	7	73	11	21	14	26	27	34	4	3	21	12	25	0	20	67	490.2	184	11	3
41	550	124	56	46	24	149	20	50	30	30	49	100	10	22	30	16	22	3	29	46	719.3	284	12	2
42	556	124	69	58	34	188	20	37	20	32	36	58	17	16	27	26	33	2	28	75	631.7	260	12	7
43	557	133	66	48	39	122	23	35	17	22	48	47	10	12	19	19	56	6	34	77	623.2	229	12	7
44	560	45	29	29	10	113	6	21	17	18	22	28	4	5	16	8	28	1	26	60	742.1	278	12	3
45	569	96	47	36	15	71	14	26	13	28	25	71	11	8	20	12	24	1	18	13	544.8	157	12	3
46	934	139	48	42	15	205	25	61	28	21	40	67	14	21	25	18	36	2	18	90	670.6	258	12	1
47	935	139	76	30	30	144	19	37	23	37	39	101	12	24	28	17	56	4	24	85	649.0	227	12	2
48	936	99	35	40	19	121	40	38	19	39	41	68	5	17	27	10	53	2	29	70	698.4	281	12	1
49	937	168	74	34	25	181	26	49	33	30	42	161	8	21	26	17	51	2	28	115	604.6	220	12	1
50	938	124	48	26	11	132	23	42	21	27	24	63	4	20	16	24	31	12	20	75	591.6	226	12	1

OBS	PLANE	X11	X12	X13	X14	X22	X24	X41	X42	X44	X45	X46	X47	X49	X51	X52	X61	X65	X71	X72	HRS	SORT	MO	GRP
51	939	145	74	40	36	161	18	46	48	29	43	81	8	27	27	13	35	5	37	71	679.9	270	12	2
52	940	119	60	52	20	135	34	46	44	21	47	88	10	28	25	11	39	1	26	67	575.3	215	12	1
53	941	135	75	41	29	125	35	49	27	41	46	91	15	21	28	6	45	1	24	86	655.4	260	12	1
54	942	137	64	56	47	131	10	59	35	46	67	55	11	26	31	13	45	4	43	94	776.3	329	12	1
55	943	136	43	30	12	124	29	39	17	39	40	49	14	22	16	23	60	1	38	39	559.0	223	11	2
56	944	129	39	45	30	145	17	37	59	26	56	65	8	36	23	29	47	0	26	84	546.9	192	12	2
57	945	84	29	19	35	190	20	23	33	22	52	44	3	25	39	14	48	5	34	44	635.0	256	12	1
58	946	138	50	44	38	180	28	40	15	31	47	68	13	20	16	30	71	0	22	56	724.1	272	12	1
59	947	157	68	50	34	205	22	55	38	36	47	51	11	26	42	15	32	18	29	89	691.0	302	12	2
60	948	53	34	12	11	72	14	21	11	25	18	66	3	9	22	16	38	0	23	49	714.1	238	12	3
61	949	52	34	20	11	99	8	23	12	26	9	40	5	12	10	23	24	4	20	27	690.0	229	12	3
62	950	65	28	22	9	74	7	22	10	21	25	74	4	4	15	16	27	0	37	44	795.4	310	12	3
63	951	129	58	29	13	155	8	17	18	19	31	43	5	9	13	20	30	3	11	54	701.0	250	12	4
64	1259	85	39	30	22	135	16	39	33	37	57	69	7	17	33	20	37	1	25	86	628.7	228	12	1
65	1260	70	31	25	25	136	21	39	28	10	43	66	8	28	23	9	32	0	12	59	331.8	135	11	2
66	1261	100	37	19	29	149	34	10	29	33	33	38	5	35	24	35	44	2	33	86	707.8	310	12	1
67	1262	124	46	32	18	143	17	33	20	28	45	53	3	17	29	26	59	2	47	88	759.6	289	12	1
68	1263	141	48	54	29	165	21	28	33	34	74	66	4	19	27	21	40	11	45	104	530.4	185	12	1
69	1264	89	49	47	20	156	22	21	63	26	46	39	6	29	20	30	60	29	30	91	657.0	286	12	2
70	1265	134	41	30	32	171	28	28	32	27	66	67	8	13	24	26	52	6	49	102	554.5	228	12	1
71	1266	94	28	54	37	154	14	62	32	13	42	39	13	31	38	16	42	0	40	119	627.7	245	12	1
72	1267	103	31	38	32	100	12	23	24	10	46	79	6	14	26	24	62	6	36	69	696.6	244	12	1
73	1268	152	73	50	30	157	26	53	23	32	61	90	13	33	35	17	49	2	32	88	517.7	192	12	1
74	1269	107	64	45	26	118	27	30	28	27	54	46	5	20	17	22	51	1	36	53	805.4	287	12	1
75	1270	105	50	35	11	139	20	35	23	26	67	77	4	24	18	29	50	4	45	92	659.0	248	12	1

OBS	PLANE	X11	X12	X13	X14	X22	X24	X41	X42	X44	X45	X46	X47	X49	X51	X52	X61	X65	X71	X72	HRS	SORT	MO	GRP
76	1271	89	32	37	38	155	16	39	21	23	44	57	10	25	26	27	34	4	23	61	575.2	260	12	2
77	1272	102	66	32	32	141	29	41	30	22	63	60	7	31	29	17	51	3	28	66	645.5	248	12	1
78	1273	116	53	34	15	164	37	45	39	32	60	100	13	26	39	22	35	2	42	89	617.5	222	12	1
79	1274	89	42	49	19	142	16	32	19	24	41	84	5	21	26	22	59	2	28	89	676.9	282	12	2
80	1275	123	44	33	23	151	25	36	24	29	35	72	13	24	37	34	54	8	24	93	674.0	271	12	1
81	1276	124	46	27	29	120	22	53	25	43	46	39	8	22	20	10	36	3	24	84	865.9	336	12	1
82	1288	95	66	33	21	129	13	31	15	29	28	30	16	15	13	13	29	6	41	66	610.3	208	10	7
83	1289	50	31	22	9	90	10	20	9	11	33	18	2	9	11	12	27	4	35	61	926.7	383	12	8
84	1290	96	67	42	32	194	13	51	21	24	32	23	8	12	31	18	41	3	23	37	772.7	278	12	7
85	1291	43	26	21	14	98	13	10	12	17	20	16	4	11	10	16	34	11	19	30	666.6	216	12	3
86	1292	63	43	16	14	98	7	18	10	22	19	39	10	14	15	15	30	4	47	41	779.3	228	12	3
87	1293	60	35	33	6	63	7	18	12	16	27	23	3	4	6	15	24	7	21	37	693.4	192	11	4
88	1294	78	44	17	31	93	7	28	18	17	23	37	5	4	13	7	39	.	27	74	666.7	251	11	4
89	1295	100	66	24	19	93	8	17	21	16	25	54	8	17	11	12	37	2	46	60	698.3	239	12	4
90	1296	52	25	29	12	59	5	16	14	25	27	45	6	5	11	9	21	0	25	28	681.6	217	12	4
91	1298	55	42	18	11	69	9	15	15	29	20	29	9	11	14	6	17	0	43	18	716.8	231	12	3
92	1299	35	12	26	15	87	7	27	8	12	22	20	3	6	15	17	30	8	9	44	766.5	306	12	8
93	1821	79	52	23	13	74	13	24	14	18	17	41	4	7	8	6	33	3	23	58	536.1	142	11	3
94	1827	84	32	19	22	84	15	32	18	17	24	56	4	11	7	15	63	1	32	31	644.1	200	12	4
95	1836	62	16	43	11	72	9	10	13	16	44	37	7	8	15	12	.	1	22	29	479.9	74	9	3
96	1855	162	85	44	37	179	22	45	19	32	33	59	10	30	19	30	54	3	28	68	678.9	288	12	7
97	1859	112	44	33	32	93	21	35	12	16	17	20	9	10	10	11	21	16	24	46	364.5	111	9	7
98	2360	236	51	33	33	91	14	45	33	37	22	35	15	13	19	9	45	9	14	64	516.2	75	10	.
99	2365	86	24	37	35	96	19	49	28	27	45	50	8	18	19	7	39	2	16	50	418.8	99	11	.
100	2366	124	32	46	20	123	6	51	18	35	36	31	12	23	22	3	54	5	32	86	513.1	85	12	2

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   19:54 SUNDAY, MAY 21, 1978   5

OBS	PLANE	X11	X12	X13	X14	X22	X24	X41	X42	X44	X45	X46	X47	X49	X51	X52	X61	X65	X71	X72	HRS	SORT	MO	GRP
101	6566	95	55	36	28	160	15	48	31	32	59	71	8	29	35	24	44	4	22	94	827.2	315	12	.
102	6579	72	36	23	12	101	24	27	16	14	20	63	6	24	15	9	31	2	23	52	770.2	284	12	4
103	6580	59	41	10	10	86	8	24	4	18	28	46	9	5	12	3	24	5	27	49	764.8	288	12	3
104	6581	127	41	34	27	156	25	37	31	19	57	58	2	19	22	5	31	4	23	78	639.4	264	11	2
105	6582	168	66	32	28	140	17	57	25	31	50	71	10	22	30	15	40	5	23	102	631.4	198	11	2
106	6583	130	45	33	25	157	21	40	20	25	34	96	8	11	30	27	42	7	34	64	471.9	179	11	2
107	7680	62	25	35	18	87	9	34	15	18	37	29	5	11	12	14	35	2	50	41	540.2	196	8	.
108	7681	124	64	41	26	106	12	41	21	36	24	67	6	20	15	4	37	4	30	69	.	.	.	2
109	7765	79	35	29	17	116	14	23	12	14	30	75	7	13	12	9	53	4	37	49	690.9	293	12	3
110	7766	143	128	36	55	109	29	49	37	78	22	34	8	23	16	8	26	2	23	46	424.0	264	11	16
111	7767	122	56	42	13	145	19	36	17	33	42	87	5	19	19	22	54	5	29	59	516.7	173	11	17
112	7768	60	41	39	10	85	9	24	13	19	13	30	9	6	13	12	29	0	42	45	462.9	161	12	4
113	7769	75	36	29	12	75	15	20	11	35	38	49	8	8	16	11	46	5	46	68	689.6	193	12	3
114	7771	86	28	44	12	105	9	26	13	15	12	54	3	4	11	2	27	6	44	41	571.5	128	12	3
115	7773	73	51	42	27	82	16	22	3	39	25	63	4	7	12	7	43	5	29	57	673.6	184	12	17
116	7776	87	92	41	41	109	28	31	32	87	21	41	13	9	19	23	37	3	42	38	577.0	325	11	16
117	7777	59	30	47	19	56	10	32	10	12	52	50	8	4	9	10	30	4	27	68	624.9	231	12	8
118	7778	98	33	35	19	130	28	47	18	28	33	59	11	11	10	4	36	3	12	41	330.8	84	10	18
119	7779	154	98	45	43	111	14	44	29	86	19	27	9	25	25	26	31	3	37	42	458.6	285	11	16
120	7781	75	56	14	22	87	12	17	15	20	26	42	7	11	20	14	37	1	39	51	510.9	155	10	3
121	7782	64	31	44	15	100	15	27	14	46	21	64	5	7	12	8	45	3	28	62	492.1	135	11	17
122	7783	67	37	37	15	75	11	34	7	31	27	77	11	9	13	19	34	5	35	44	570.5	169	10	17
123	7784	82	59	56	21	87	12	30	7	54	30	84	10	7	13	20	43	3	38	71	645.6	194	11	17
124	7786	35	34	30	11	61	7	15	7	6	14	54	8	7	11	15	21	1	16	32	529.2	121	10	3
125	7787	154	57	40	31	190	15	47	21	55	35	65	12	12	21	19	52	1	39	54	526.4	183	12	4

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   19:54 SUNDAY, MAY 21, 1978   6

OBS	PLANE	X11	X12	X13	X14	X22	X24	X41	X42	X44	X45	X46	X47	X49	X51	X52	X61	X65	X71	X72	HRS	SORT	MO	GRP
126	7788	122	49	66	27	108	12	42	8	57	24	75	9	11	10	9	57	1	35	44	601.6	192	12	17
127	7790	62	24	13	8	73	11	17	13	14	14	46	7	8	9	7	22	0	19	26	429.1	97	11	3
128	7791	114	58	33	14	142	14	24	22	24	24	90	7	22	11	7	23	2	32	57	592.5	231	12	3
129	7792	84	21	51	22	67	13	29	8	32	21	47	13	10	19	14	51	1	42	53	541.7	173	12	17
130	7793	50	32	26	11	88	9	28	7	16	37	45	8	7	19	26	24	2	29	31	678.3	241	12	3
131	7794	80	41	28	24	129	14	29	15	15	38	40	8	11	12	9	43	4	44	50	824.5	318	12	3
132	7795	81	39	28	21	68	15	27	18	31	39	72	8	13	12	9	31	7	49	55	646.0	228	12	3
133	7796	95	45	41	19	89	14	35	10	25	30	38	8	17	14	13	32	1	27	51	731.1	149	12	3
134	7799	106	78	40	14	176	34	34	20	34	23	56	14	22	15	25	24	6	50	49	481.6	170	10	4
135	7800	80	22	48	28	80	18	21	14	20	29	72	9	17	11	2	39	3	25	47	610.1	228	11	8
136	7803	68	19	37	23	76	24	33	8	17	19	16	16	7	7	12	24	4	30	34	597.9	253	12	8
137	7804	138	55	31	29	138	18	21	25	26	28	31	9	16	12	6	35	0	31	58	640.2	228	12	3
138	7806	115	143	57	28	99	27	36	33	106	23	22	13	17	11	14	71	3	40	63	590.2	358	12	3
139	7807	156	65	48	26	224	40	47	28	45	69	99	13	19	41	16	46	17	26	71	589.4	214	12	1
140	7808	74	34	29	25	95	5	30	14	18	27	58	8	8	7	9	43	8	24	33	661.5	244	12	4
141	7809	200	78	55	58	190	24	77	28	58	53	76	22	44	36	23	31	2	18	45	512.6	169	12	1
142	7811	77	13	25	20	90	20	26	5	20	36	38	10	5	14	5	30	1	24	41	603.7	210	12	8
143	7812	77	23	23	26	76	14	22	12	14	38	38	12	6	14	13	31	4	33	37	579.2	211	11	8
144	7813	133	65	39	25	289	15	45	23	18	74	78	11	28	28	16	30	12	28	30	560.5	235	12	19
145	7814	73	28	31	28	93	31	32	9	41	29	77	19	18	25	14	35	11	15	62	592.5	190	12	17
146	7816	57	23	34	15	99	14	16	10	15	15	31	5	6	15	13	34	2	22	38	704.9	258	12	3
147	7818	138	71	51	23	188	12	48	15	27	19	45	5	18	19	7	34	1	46	58	748.0	266	12	3
148	7819	70	13	33	19	71	16	32	10	22	23	20	6	6	15	10	20	1	13	21	354.9	122	10	8
149	7820	71	46	43	16	54	6	17	12	25	29	90	7	11	17	11	29	11	37	50	679.2	207	12	3
150	7821	93	37	25	23	114	10	20	14	15	22	46	2	15	10	11	36	2	31	38	702.9	231	12	3

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   19:54 SUNDAY, MAY 21, 1978   7

OBS	PLANE	X11	X12	X13	X14	X22	X24	X41	X42	X44	X45	X46	X47	X49	X51	X52	X61	X65	X71	X72	HRS	SORT	MO	GRP
151	7823	61	31	17	10	54	14	16	10	17	35	43	5	8	13	1	25	2	11	35	428.1	156	10	3
152	7824	75	8	46	28	63	15	12	7	18	45	30	12	10	10	5	29	3	35	38	777.4	267	11	8
153	7825	108	67	59	20	118	24	40	28	70	43	41	12	15	24	5	31	4	27	64	338.0	124	7	8
154	7828	90	34	54	16	77	15	35	18	37	26	32	9	11	11	15	37	3	34	37	361.3	168	11	17
155	7829	75	46	41	27	89	26	34	15	37	20	37	4	10	19	15	39	4	36	50	464.0	281	9	16
156	7830	100	84	40	17	115	16	36	27	84	38	34	9	12	24	21	31	8	38	72	660.9	332	12	16
157	7831	164	90	46	44	154	36	34	28	83	39	24	6	21	15	6	36	2	22	57	531.0	327	12	16
158	7833	25	14	19	6	36	3	11	6	7	4	13	1	2	17	5	15	3	7	17	171.1	46	5	13
159	7835	90	40	33	14	98	12	32	14	27	36	58	7	17	25	2	44	2	30	54	683.6	279	12	4
160	7836	100	38	26	19	156	16	28	24	40	23	125	3	16	9	5	48	1	27	24	406.0	94	12	3
161	7837	79	91	39	28	68	15	31	22	56	27	24	8	13	10	14	45	8	27	40	451.9	287	10	3
162	7838	79	42	23	19	91	18	10	4	11	16	33	7	9	13	13	31	3	35	44	805.3	253	12	3
163	7839	75	17	10	16	63	6	21	6	14	16	29	4	11	19	8	31	4	38	53	566.9	194	11	3
164	7840	84	28	40	20	64	33	14	9	6	32	51	10	6	2	5	19	8	22	26	474.5	157	11	8
165	7841	58	37	19	13	101	8	28	12	11	13	53	4	5	14	11	35	12	65	70	677.3	212	12	3
166	7842	87	34	59	12	109	19	45	10	18	55	47	3	15	12	5	35	4	29	45	510.9	155	11	17
167	7845	91	56	27	24	145	19	26	21	33	18	39	7	25	12	4	17	0	10	9	346.9	171	9	19
168	7846	110	60	49	35	159	31	36	20	36	46	54	13	13	21	10	57	2	31	57	623.5	229	12	16
169	7847	161	73	24	30	297	29	48	24	31	50	78	14	28	39	10	38	7	20	35	612.5	258	12	19
170	7849	162	44	51	36	327	30	49	27	48	67	47	5	25	31	12	30	19	28	29	629.4	270	12	19
171	7850	60	29	21	16	74	2	13	9	25	26	65	2	8	15	2	44	0	13	48	697.9	139	12	3
172	7851	88	76	34	26	105	24	46	21	57	12	28	18	24	11	11	43	14	16	59	523.1	325	12	16
173	7854	87	76	48	19	116	33	45	19	50	36	78	9	18	18	16	47	7	37	53	585.9	178	12	17
174	7857	141	52	30	27	142	19	45	16	24	34	44	3	10	13	9	43	6	47	29	633.1	253	12	3
175	7858	70	21	23	10	73	8	14	18	9	24	69	6	9	18	17	33	0	38	70	712.7	274	12	4

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   19:54 SUNDAY, MAY 21, 1978   8

OBS	PLANE	X11	X12	X13	X14	X22	X24	X41	X42	X44	X45	X46	X47	X49	X51	X52	X61	X65	X71	X72	HRS	SORT	MO	GRP
176	7859	52	14	41	22	68	7	30	6	16	39	67	4	17	13	15	17	1	20	55	677.6	264	12	8
177	7860	59	28	28	18	51	7	21	12	14	18	56	4	8	7	17	29	0	21	48	672.0	227	12	3
178	7861	63	30	43	23	123	10	26	12	19	27	74	13	11	25	6	32	4	27	53	645.4	220	12	3
179	7864	90	26	32	22	73	11	19	9	21	27	36	3	10	15	3	19	3	25	30	678.5	254	12	8
180	7865	81	21	27	29	73	23	22	8	15	28	24	5	7	25	9	20	7	31	43	739.4	252	12	8
181	7866	123	78	52	42	188	28	27	23	34	44	46	10	19	25	20	35	4	35	66	722.9	246	12	7
182	7868	119	64	48	28	173	18	31	18	23	41	37	16	14	41	22	33	4	29	67	577.0	202	12	7
183	7869	63	44	19	10	97	10	19	20	5	17	59	8	8	15	8	46	11	20	49	742.6	302	12	16
184	7871	139	39	26	29	278	29	42	23	25	41	42	14	28	17	24	29	7	23	39	586.3	275	12	19
185	7872	211	98	58	33	102	27	50	24	89	19	61	5	21	18	20	49	10	23	32	532.3	309	11	3
186	7874	42	38	25	22	69	9	22	7	33	27	41	7	3	7	22	40	2	15	57	478.1	152	10	17
187	7876	85	35	41	14	161	11	24	20	22	31	48	8	9	17	4	35	10	25	44	575.4	189	12	3
188	7877	68	33	33	47	35	9	26	11	19	45	31	2	7	8	2	25	3	37	32	289.1	104	9	8
189	7879	115	85	40	29	144	13	49	22	25	28	36	26	20	27	18	40	2	26	73	622.5	196	12	7
190	7880	100	50	32	14	105	13	29	17	33	43	42	8	9	22	7	38	2	37	49	661.8	182	12	4
191	7881	84	30	34	23	73	12	23	15	19	38	39	15	8	15	3	41	2	25	45	410.4	159	11	8
192	7882	51	19	24	9	49	6	21	7	22	26	37	7	7	11	6	28	5	38	67	880.9	174	12	3
193	7884	188	93	56	55	158	30	60	21	44	87	70	19	27	29	13	24	1	31	34	276.8	96	11	1
194	7885	87	56	40	25	98	13	46	27	25	31	48	12	16	28	19	21	8	48	78	594.8	228	10	2
195	7887	86	43	44	18	118	22	33	18	30	42	48	6	20	18	23	38	1	23	44	762.8	162	12	3
196	7888	51	38	22	21	112	23	22	9	9	12	35	5	5	13	21	35	0	18	29	651.7	143	12	3
197	7889	112	64	38	15	156	1	19	12	17	10	44	10	10	13	9	14	0	23	39	524.3	107	12	3
198	7890	167	63	55	35	226	31	71	39	41	54	69	16	44	22	8	38	5	21	45	343.5	99	10	19
199	7891	60	27	48	10	92	9	40	15	25	26	53	14	10	9	14	47	14	17	52	639.4	190	12	17
200	7892	45	25	45	10	62	10	30	14	24	22	46	11	10	7	13	42	14	19	51	501.7	110	11	3

STATISTICAL ANALYSIS SYSTEM 19:54 SUNDAY, MAY 21, 1978 9

OBS	PLANE	X11	X12	X13	X14	X22	X24	X41	X42	X44	X45	X46	X47	X49	X51	X52	X61	X65	X71	X72	HRS	SORT	MO	GRP
201	7893	109	48	29	14	108	21	31	6	44	16	54	18	10	17	14	37	5	31	48	767.8	285	12	17
202	7894	109	40	40	16	56	8	36	12	36	19	61	6	11	16	11	30	2	24	59	490.3	149	12	3
203	7895	55	35	22	16	115	7	37	12	23	27	37	18	11	11	16	37	0	16	29	669.7	217	12	8
204	7896	125	40	45	27	110	15	41	22	31	66	108	6	21	16	10	38	5	17	59	408.7	134	11	3
205	7879	40	24	14	8	71	6	20	11	7	25	31	4	8	10	3	21	3	14	21	527.6	186	10	8
206	7898	99	28	47	25	104	12	35	6	16	38	43	7	12	14	16	38	4	27	63	563.7	123	12	3
207	7899	71	19	25	8	88	7	27	14	17	36	87	7	10	18	20	28	1	25	53	527.2	150	10	3
208	9810	74	59	28	11	105	11	42	21	41	21	44	12	24	18	19	21	2	19	41	641.7	212	12	3
209	9811	166	101	38	43	163	29	39	8	39	48	45	16	18	17	16	36	1	31	101	637.4	235	12	7
210	9812	122	47	32	20	106	14	32	19	10	29	49	11	11	18	15	24	4	19	40	595.1	179	10	4
211	9813	89	36	26	13	90	6	14	9	12	14	28	8	9	17	6	23	4	39	26	636.5	127	12	3
212	9814	53	42	41	17	82	8	26	8	20	12	42	6	3	17	7	33	3	36	45	573.4	126	11	3
213	9815	103	53	47	16	125	13	24	19	31	31	41	8	13	17	8	41	6	27	58	519.5	115	11	3
214	9816	40	27	25	9	57	8	13	6	9	25	53	8	7	12	2	32	2	37	43	507.3	171	10	3
215	9817	53	17	16	8	40	8	13	10	15	34	50	6	10	9	4	19	4	8	27	663.8	200	12	3

OBS	PLANE	X11	X12	X13	X14	X22	X24	X41	X42	X44	X45	X46	X47	X49	X51	X52	X61	X65	X71	X72	HRS	SORT	MO
1	1	359	129	164	266	305	29	29	31	101	47	27	10	28	38	37	47	5	41	48	636.0	176	12
2	2	177	74	109	[illegible]	184	28	37	33	115	74	61	41	38	54	47	74	5	35	73	1402.9	370	12
3	4	143	44	87	[illegible]	145	17	42	18	89	41	43	35	20	46	15	31	7	33	44	918.9	254	10
4	5	118	21	86	50	108	21	24	8	43	23	20	9	28	50	36	61	2	56	47	1162.4	364	12
5	7	109	38	43	45	140	6	14	11	33	20	23	8	37	24	18	51	3	33	33	1144.7	282	12
6	9	129	41	68	49	150	14	10	26	59	29	47	16	22	29	25	43	7	64	45	1193.7	320	12
7	10	223	72	159	65	216	57	38	29	151	82	26	30	44	43	31	61	2	47	94	1348.2	341	12
8	11	148	51	37	51	145	13	19	16	57	29	29	21	29	27	37	47	6	18	37	1213.6	336	12
9	12	218	84	128	124	155	18	20	13	53	22	24	18	10	29	31	41	2	32	53	777.7	236	11
10	13	199	51	196	57	198	33	33	11	137	34	42	23	37	50	32	69	2	28	63	1070.7	331	12
11	15	93	38	78	45	146	5	25	11	58	26	25	6	23	30	17	50	3	26	31	1423.8	376	12
12	17	176	58	117	67	164	34	55	26	91	47	48	29	34	45	48	70	5	45	77	1544.0	374	12
13	18	142	31	71	35	100	28	22	11	62	22	38	8	14	14	37	71	4	42	103	1337.2	347	12
14	19	163	66	105	57	140	42	27	15	99	43	36	22	33	33	31	60	2	35	49	836.5	235	11
15	20	140	70	94	76	163	11	28	19	101	33	35	17	34	18	19	49	5	42	69	1044.4	248	12
16	21	147	87	109	100	189	41	44	20	79	56	52	17	42	36	36	60	12	37	72	1182.8	311	12
17	22	319	88	141	145	230	20	26	9	80	41	23	15	27	47	25	74	2	51	29	560.0	192	12
18	23	413	120	212	276	332	33	33	24	65	56	42	58	31	50	26	55	5	46	67	514.1	144	11
19	24	190	117	114	87	191	24	36	26	122	48	37	14	33	30	44	83	2	45	69	1025.1	280	12
20	25	163	28	69	93	147	26	26	23	45	89	49	17	25	31	33	69	3	46	88	1256.5	288	11
21	26	150	46	82	61	126	9	23	12	43	26	40	9	16	24	28	55	3	27	46	1139.7	307	12
22	27	597	200	321	375	469	42	28	41	77	50	30	31	28	47	55	69	4	80	54	778.8	214	12
23	29	135	38	45	35	136	11	23	10	58	20	34	12	18	24	11	36	6	18	21	909.4	248	11
24	30	192	48	65	68	126	19	22	18	66	54	32	9	27	40	24	66	5	30	46	1137.1	291	12
25	31	197	41	119	125	189	17	38	20	62	49	32	12	24	30	44	42	12	45	51	539.4	142	10

OBS	PLANE	X11	X12	X13	X14	X22	X24	X41	X42	X44	X45	X46	X47	X49	X51	X52	X61	X65	X71	X72	HRS	SORT	MO
26	128	145	48	53	54	146	14	21	20	57	32	34	14	21	20	27	50	11	32	37	822.9	245	10
27	129	111	38	53	36	101	12	25	16	24	19	38	11	12	19	29	60	5	34	45	741.7	217	11
28	130	102	27	64	48	113	10	29	12	34	16	34	6	23	35	36	40	5	44	39	1112.3	339	12
29	132	215	78	118	65	173	25	34	21	128	43	48	28	49	28	10	58	8	37	48	1045.0	278	12
30	133	154	78	115	76	138	22	39	24	105	63	46	22	39	32	31	55	10	36	63	1169.0	317	12
31	138	130	31	79	57	143	11	25	24	42	50	42	7	26	32	30	58	2	58	39	1244.5	321	12
32	139	104	27	46	48	148	20	25	11	45	11	56	7	18	24	18	45	4	17	30	933.6	278	11
33	140	86	25	70	29	98	12	19	10	66	24	21	12	15	13	22	34	6	24	50	652.4	171	8
34	141	104	28	63	50	122	9	20	22	22	26	70	22	20	33	24	64	8	60	54	1387.4	405	12
35	142	89	26	54	69	112	11	32	12	45	26	43	13	12	27	27	75	4	46	60	1053.3	382	12
36	143	142	39	57	48	159	10	35	28	63	33	43	7	38	39	27	56	2	46	46	1268.7	329	12
37	145	91	40	45	38	80	22	21	16	32	19	35	17	19	30	32	73	1	40	56	1214.6	377	12
38	146	277	113	136	71	340	31	52	29	165	61	33	40	53	33	33	73	5	48	99	1309.6	329	12
39	147	119	54	85	68	91	10	36	18	44	46	35	13	27	46	34	46	2	47	58	1153.9	311	12
40	148	213	32	65	106	108	17	37	25	29	94	29	7	30	45	39	63	3	44	49	964.5	231	12
41	149	194	104	130	98	185	27	48	29	126	73	51	23	41	63	45	84	4	50	99	1171.9	312	12
42	150	149	28	48	62	165	16	26	12	61	13	35	12	16	38	27	53	3	53	49	1209.1	349	12
43	151	136	35	73	87	183	14	34	39	32	71	26	18	29	31	23	60	3	54	61	945.6	245	11
44	153	324	122	185	177	341	33	56	18	98	63	56	21	30	48	28	40	5	26	68	759.4	196	12
45	154	181	75	134	90	201	13	44	24	125	62	53	34	39	36	35	85	2	53	82	1531.4	354	12
46	155	260	106	143	124	294	26	61	21	130	66	46	26	44	55	31	76	7	42	67	1375.2	353	12
47	156	215	83	144	131	283	29	35	35	53	44	20	16	25	56	32	80	2	42	73	698.1	188	12
48	157	460	132	244	272	423	60	41	35	104	79	60	21	28	62	36	58	6	51	43	736.1	195	12
49	158	109	44	67	56	124	29	19	12	48	23	57	13	14	38	27	66	3	46	47	903.1	313	11
50	159	104	37	55	59	100	11	24	9	43	29	54	18	14	38	19	66	6	45	59	1009.6	328	11

OBS	PLANE	X11	X12	X13	X14	X22	X24	X41	X42	X44	X45	X46	X47	X49	X51	X52	X61	X65	X71	X72	HRS	SORT	MO
51	160	136	30	76	57	116	6	21	19	45	22	25	17	17	40	20	42	1	21	44	1365.2	359	12
52	161	84	35	55	44	103	15	26	5	22	18	49	23	18	31	40	56	3	45	62	770.6	223	10
53	164	61	19	59	44	129	10	25	10	38	23	37	17	10	33	44	65	5	39	60	1326.4	368	12
54	165	255	103	161	114	266	36	55	39	149	70	105	46	65	78	69	122	5	81	120	1651.0	578	12
55	170	209	103	118	89	183	47	34	33	124	57	30	28	58	50	39	62	5	52	55	1125.1	276	12
56	171	143	39	52	54	131	24	17	14	49	22	34	15	29	37	37	51	6	23	42	1321.0	353	12
57	172	163	36	65	59	145	12	32	8	54	19	39	10	17	41	39	38	3	27	46	849.3	241	11
58	173	193	70	104	72	169	27	33	18	112	53	43	22	34	27	32	47	2	28	88	1096.9	273	11
59	176	120	44	78	47	120	16	16	9	51	24	53	12	28	32	33	49	1	26	29	1090.6	298	12
60	177	113	40	35	42	110	17	17	12	37	24	27	13	18	26	36	56	2	27	42	903.8	242	10
61	178	96	25	54	39	82	17	11	17	17	12	31	8	19	28	14	48	6	34	40	901.1	237	10
62	180	131	43	74	70	165	13	17	16	52	29	55	11	39	37	49	55	4	31	66	1110.0	312	12
63	181	132	46	75	43	161	20	24	14	50	25	30	19	32	43	25	60	2	36	59	1038.1	282	11
64	182	129	36	57	54	123	9	22	12	33	17	50	15	33	34	24	57	1	39	24	1454.4	389	12
65	183	201	47	118	92	171	19	32	24	79	42	34	26	29	34	12	42	7	30	52	859.3	244	11
66	184	357	169	243	234	300	30	27	26	125	69	39	15	37	53	35	72	2	48	44	674.1	184	12
67	185	130	32	86	40	127	19	30	16	40	27	47	8	19	27	32	73	3	36	43	1173.0	313	11
68	188	118	29	47	57	115	10	18	8	51	22	34	14	25	29	28	52	5	26	30	840.3	222	11
69	189	98	28	69	59	115	7	33	16	37	24	20	10	15	21	21	49	2	34	35	993.4	274	11
70	190	129	38	55	40	145	15	17	7	53	16	65	10	25	23	17	47	2	37	45	1017.3	251	12
71	191	128	60	79	88	144	12	31	13	40	72	35	5	32	47	36	75	7	51	78	1399.5	376	12
72	192	121	40	84	70	139	5	23	15	41	22	30	21	20	49	49	63	3	37	48	1160.7	443	12
73	193	471	112	212	273	412	37	48	22	102	55	19	19	23	31	45	34	3	37	50	620.8	171	12
74	194	356	150	258	227	305	28	29	22	130	36	45	15	44	54	34	84	6	35	77	703.6	196	12
75	197	112	33	92	63	138	12	37	13	48	33	57	18	22	32	30	83	4	55	56	1226.6	397	12

OBS	PLANE	X11	X12	X13	X14	X22	X24	X41	X42	X44	X45	X46	X47	X49	X51	X52	X61	X65	X71	X72	HRS	SORT	MO
76	198	69	24	36	25	79	1	9	9	35	21	16	13	23	23	13	28	1	21	23	885.9	205	11
77	200	151	48	54	54	142	24	34	13	48	28	19	8	25	42	28	88	2	52	50	1332.6	344	12
78	201	133	35	78	48	130	19	26	14	58	26	31	19	21	27	28	50	1	31	34	1321.9	372	12
79	205	94	32	42	54	114	13	9	8	36	15	21	8	20	20	28	50	4	27	39	1171.2	280	11
80	206	135	41	77	73	112	9	20	15	40	15	53	10	22	29	31	31	2	51	48	1295.4	340	12
81	208	138	46	77	53	114	22	26	11	63	39	49	17	19	36	24	56	3	41	34	1411.1	370	12
82	216	99	52	70	47	134	14	18	7	46	27	28	10	19	25	26	52	1	35	40	1084.0	290	12
83	219	157	32	47	58	126	16	24	11	41	23	27	10	22	19	16	46	2	32	33	1047.6	275	11
84	221	199	107	137	87	175	38	48	41	155	92	42	32	63	37	51	62	3	49	59	1110.3	293	12
85	223	191	73	100	92	192	21	46	9	112	56	26	21	53	40	34	75	8	53	44	969.6	248	11
86	224	153	57	97	63	133	29	32	18	93	37	13	31	32	39	34	69	10	47	44	963.5	277	11
87	225	111	21	65	46	126	19	14	14	24	25	20	8	20	22	22	62	2	36	27	1395.5	408	12
88	226	170	42	101	86	174	20	15	23	38	93	29	12	22	56	32	65	5	33	73	1167.7	286	12
89	227	134	39	80	54	129	14	25	14	42	30	30	30	15	24	27	54	1	29	55	1005.0	295	12
90	228	75	24	62	31	87	5	31	8	26	18	27	14	15	24	34	47	7	66	56	863.0	281	10
91	229	89	33	73	46	141	9	24	19	53	29	40	21	22	40	33	81	4	67	67	1072.6	361	12
92	230	158	34	72	67	137	27	28	16	35	65	28	12	23	50	43	52	4	29	62	1280.0	327	12
93	231	146	50	72	79	151	14	33	24	45	97	28	24	29	36	16	78	1	47	55	1179.0	320	11
94	232	69	35	51	48	130	16	13	14	27	16	33	18	14	33	44	98	9	50	50	1092.1	290	10
95	233	162	46	94	73	124	30	26	21	49	64	23	12	26	28	29	67	7	37	94	1188.3	328	12
96	234	183	33	80	88	168	18	27	16	45	48	26	10	32	51	32	70	5	44	49	947.3	239	11
97	235	104	39	74	50	137	16	19	25	54	14	64	19	17	34	48	66	2	72	53	1118.4	351	12
98	236	82	26	42	61	112	9	10	16	36	66	29	7	18	37	15	39	0	27	51	632.0	164	9
99	237	97	23	59	51	94	13	23	14	44	23	34	13	11	34	37	70	7	40	36	1051.6	325	11
100	238	217	46	132	95	156	27	40	35	39	59	36	14	32	49	43	31	4	43	73	1264.4	334	12

OBS	PLANE	X11	X12	X13	X14	X22	X24	X41	X42	X44	X45	X46	X47	X49	X51	X52	X61	X65	X71	X72	HRS	SORT	MO
101	239	142	32	65	65	146	13	15	11	29	46	24	11	21	26	23	54	2	26	52	819.9	220	10
102	240	124	50	81	69	116	9	25	15	53	31	53	15	25	40	42	66	10	47	61	1332.9	395	12
103	241	70	19	54	33	96	6	15	8	35	29	47	20	13	25	22	60	6	51	43	1000.7	285	11
104	242	199	58	102	98	135	18	37	22	52	82	26	17	36	35	45	108	3	42	79	1153.1	314	12
105	243	87	23	69	45	97	16	21	21	29	32	58	12	22	29	40	73	2	26	45	827.6	266	10
106	244	141	42	76	54	133	24	27	7	51	29	40	16	17	28	43	79	7	82	66	1012.3	299	11
107	245	196	43	90	99	161	26	40	30	54	94	40	17	41	54	31	78	3	36	68	1301.0	303	12
108	246	176	31	115	84	125	8	23	18	49	69	38	7	34	44	41	75	9	29	63	1253.7	324	12
109	247	131	45	123	82	109	9	23	25	48	81	41	14	22	29	28	59	4	41	73	916.3	218	11
110	248	87	33	67	68	107	15	19	8	41	84	38	8	19	39	50	75	2	54	43	973.1	259	11
111	249	191	57	99	94	144	19	39	29	80	90	49	13	37	25	22	53	2	45	81	939.3	251	12
112	250	171	59	112	66	117	8	17	28	51	89	43	9	28	40	51	61	2	43	60	873.7	259	12
113	251	179	44	95	75	142	16	44	23	33	63	31	17	35	40	34	62	4	51	53	1101.0	279	12
114	252	131	28	71	42	122	7	15	24	38	32	13	7	21	27	23	63	1	28	73	814.4	270	11
115	253	72	28	48	37	99	11	16	11	25	31	41	11	13	16	28	48	2	23	19	670.5	188	9
116	254	192	43	59	67	166	7	26	13	46	37	16	14	32	44	33	62	5	25	58	1226.9	348	12
117	255	92	16	52	56	90	4	11	18	22	13	30	13	16	16	33	46	3	33	45	878.9	269	11
118	256	167	32	81	76	163	20	21	18	41	57	38	12	25	34	23	53	1	41	51	890.7	257	11
119	257	95	42	87	73	115	13	32	12	52	25	38	19	17	36	29	82	3	57	64	1131.5	351	12
120	258	91	20	44	56	65	10	21	9	23	16	25	8	10	26	22	46	4	26	38	807.3	298	11
121	259	176	36	63	78	156	15	23	20	41	71	29	12	30	27	33	65	1	30	47	1047.0	270	12
122	260	260	30	87	92	181	21	37	16	50	73	54	16	30	48	43	80	2	41	64	961.5	256	12
123	261	318	101	169	280	232	24	28	20	94	39	40	23	30	54	36	57	0	57	52	523.9	142	12
124	262	188	48	83	95	142	18	36	19	38	85	40	19	30	62	38	56	1	42	63	1107.0	275	12
125	263	111	37	64	53	98	9	29	6	36	32	22	17	21	30	26	69	2	47	53	1173.1	305	12

OBS	PLANE	X11	X12	X13	X14	X22	X24	X41	X42	X44	X45	X46	X47	X49	X51	X52	X61	X65	X71	X72	HRS	SORT	MO
126	264	98	29	69	35	98	12	23	3	28	23	62	14	21	30	24	94	2	30	59	1171.3	368	12
127	268	149	35	88	69	123	6	41	15	63	66	27	14	45	34	34	63	2	31	46	942.1	262	11
128	271	227	79	124	95	188	27	51	26	113	62	43	26	35	48	51	72	6	36	72	1208.8	297	12
129	275	134	36	76	66	182	17	42	22	78	54	48	23	35	33	27	64	6	60	66	1061.3	264	10
130	276	200	67	135	98	204	25	35	29	100	50	31	20	44	25	56	56	3	41	65	894.9	294	12
131	277	90	33	59	48	157	9	19	7	36	18	28	9	28	29	22	50	5	23	29	1094.0	281	12
132	278	155	36	81	58	130	14	31	19	27	46	38	14	22	27	42	86	2	25	72	1268.5	343	12
133	280	118	42	78	69	135	15	30	34	41	70	25	13	35	26	25	45	10	39	56	1056.8	297	12
134	609	112	36	63	53	130	10	20	17	58	25	26	22	28	35	43	88	7	57	51	1243.4	321	12
135	614	153	45	82	50	122	12	22	15	34	26	35	10	25	32	29	58	3	32	34	878.1	256	12
136	616	197	106	163	83	194	39	43	22	153	74	43	35	31	18	45	67	13	35	48	1065.6	294	12
137	617	161	38	64	61	122	11	9	9	41	15	36	16	22	20	32	62	0	32	40	904.2	241	12
138	619	165	50	90	62	120	10	21	18	72	32	29	9	31	36	35	50	2	45	46	1337.0	349	12
139	620	176	59	101	53	148	6	27	21	88	30	22	37	16	33	34	71	2	36	49	958.0	287	10
140	621	268	70	95	97	276	33	30	19	129	81	25	36	43	33	43	66	16	50	64	1188.8	332	11
141	622	162	74	111	90	220	26	44	18	96	68	31	37	39	45	34	60	4	52	63	1228.4	299	12
142	623	200	81	115	104	229	39	43	20	102	58	39	37	49	46	32	80	6	50	76	825.9	203	11
143	625	255	70	80	170	181	30	25	25	56	19	33	9	38	35	30	48	5	59	61	1094.3	343	12
144	626	147	50	100	73	113	17	29	23	52	46	36	23	27	28	42	69	17	44	65	922.2	227	12
145	627	187	48	92	59	122	19	48	16	89	45	32	24	42	28	29	38	1	46	49	1075.7	270	11
146	628	246	92	123	109	200	49	44	30	138	68	44	25	70	47	41	78	6	67	104	1071.6	263	11
147	632	129	42	75	50	93	11	32	18	64	28	28	8	21	26	23	38	4	14	72	1189.7	293	12
148	635	77	21	47	54	95	10	17	17	37	14	27	3	18	19	19	41	5	34	27	738.1	248	8
149	636	66	15	29	19	65	6	8	3	23	12	23	11	11	15	10	31	1	27	33	1014.7	269	11
150	637	121	49	86	66	155	16	33	24	43	43	46	8	23	46	24	52	3	43	49	1237.1	299	12

OBS	PLANE	X11	X12	X13	X14	X22	X24	X41	X42	X44	X45	X46	X47	X49	X51	X52	X61	X65	X71	X72	HRS	SORT	MO
151	638	197	56	88	65	133	18	40	22	67	68	29	18	24	36	33	61	1	41	65	1299.3	311	12
152	640	172	55	71	76	155	23	33	19	92	48	20	12	30	34	16	76	4	29	62	889.9	265	10
153	642	169	40	85	69	147	15	19	20	57	61	20	9	28	30	40	66	4	22	30	793.8	206	11
154	643	178	53	93	68	164	16	32	18	93	43	34	18	29	31	30	59	5	30	50	947.9	255	10
155	645	134	51	91	49	140	22	31	18	70	30	20	24	31	28	23	35	2	19	31	1069.6	240	12
156	646	175	31	79	79	100	9	19	14	40	48	36	11	15	31	35	48	1	28	32	1331.4	342	12
157	648	170	56	79	61	159	18	41	20	82	35	20	13	34	20	13	35	2	29	44	1102.3	338	11
158	649	175	55	108	78	133	11	39	19	81	40	28	17	49	36	37	74	5	49	52	499.0	149	12
159	650	560	152	249	332	405	33	34	28	90	71	20	25	43	52	29	58	1	47	74	533.6	154	12
160	652	307	116	139	156	278	24	28	25	44	57	21	10	24	17	34	27	0	19	38	1181.9	350	12
161	653	124	42	72	53	144	5	12	18	48	28	35	8	28	28	19	68	1	36	39	839.8	245	11
162	2778	90	21	50	35	60	6	21	11	50	15	8	11	10	28	23	49	2	27	59	1078.1	335	12
163	4610	74	23	47	60	72	7	11	5	20	18	13	6	10	33	13	38	1	8	17	1150.1	347	12
164	4611	163	35	76	73	155	11	36	26	72	52	26	29	25	38	31	31	14	53	65	1241.2	346	12
165	4612	173	46	72	64	137	7	29	22	67	52	31	6	31	46	29	66	15	34	80	936.1	270	9
166	4613	148	65	71	68	99	10	19	19	97	42	27	19	30	39	21	57	3	24	66	940.7	264	10
167	4615	169	49	98	84	130	21	35	24	101	51	29	17	30	32	47	42	5	53	65	1123.1	330	11
168	4618	130	53	61	67	112	16	20	23	71	55	30	13	17	43	39	49	5	25	45	1325.3	361	12
169	4624	173	63	86	64	162	18	40	30	69	55	33	20	27	38	25	69	7	37	69	1229.4	401	12
170	4631	169	65	69	71	144	18	44	34	87	46	29	15	29	48	26	66	4	43	62	1141.6	339	12
171	5217	144	59	105	83	156	13	41	34	80	57	44	30	28	37	14	53	9	64	49	1357.4	325	12
172	5218	190	67	102	58	136	10	42	29	75	66	66	27	38	31	26	70	7	52	72	920.5	294	12
173	5220	177	37	70	79	110	15	39	22	47	48	29	19	18	32	43	36	7	39	78	1371.4	370	12
174	5222	193	64	96	90	158	6	36	34	60	63	47	27	21	39	32	55	9	75	93	1194.8	358	12
175	5266	69	23	40	29	43	9	6	10	21	15	27	6	8	28	20	22	3	25	28	1285.0	386	12

OBS	PLANE	X11	X12	X13	X14	X22	X24	X41	X42	X44	X45	X46	X47	X49	X51	X52	X61	X65	X71	X72	HRS	SORT	MO
176	5267	167	38	95	64	109	14	39	28	108	43	42	29	20	35	22	58	5	48	45	1344.9	364	12
177	5269	180	51	115	79	133	9	26	27	87	49	63	19	24	37	36	46	6	46	43	776.2	184	12
178	5270	157	56	72	57	93	10	24	31	29	45	46	27	20	32	34	73	11	22	25	1378.1	407	12
179	5272	123	52	103	63	162	14	32	29	59	76	56	13	18	35	40	95	7	66	51	1514.9	465	12
180	5273	167	32	97	97	120	17	35	30	101	57	31	24	19	47	39	100	5	40	90	1397.8	427	12
181	5279	177	47	84	89	142	6	27	40	139	58	28	17	22	49	25	79	3	40	58	891.0	276	10
182	6126	172	55	78	76	125	18	30	29	56	48	46	21	19	39	35	46	12	37	55	1264.3	397	12
183	6134	135	54	70	55	110	13	36	36	31	43	43	7	20	25	28	44	3	43	47	1267.3	370	12
184	6135	183	46	65	85	105	6	25	22	65	67	40	24	19	31	25	55	0	36	80	1324.4	356	12
185	6136	180	47	82	68	145	17	24	27	61	66	64	24	31	50	42	63	5	35	57	933.9	378	12
186	6137	190	44	96	62	163	10	30	23	51	58	54	27	22	39	36	74	4	27	64	1078.5	322	11
187	6144	160	41	65	65	114	15	23	26	52	51	40	26	19	25	17	65	4	25	56	1223.8	349	11
188	6152	153	52	87	103	121	19	45	30	56	69	64	28	16	35	38	71	8	45	64	1208.1	364	11
189	6162	173	64	68	80	175	33	46	20	79	77	44	39	29	34	42	74	7	51	52	932.4	260	11
190	6163	172	60	80	71	126	15	37	22	72	62	59	21	22	42	27	58	4	46	60	1283.7	401	12
191	6167	61	6	23	22	48	9	7	7	34	21	23	5	8	31	20	30	4	16	15	965.0	277	11
192	6168	204	65	103	99	151	12	45	30	135	90	63	28	37	44	36	82	6	51	76	1230.7	382	12
193	6169	153	56	68	53	136	9	47	27	97	58	47	16	22	43	36	64	1	46	55	1192.2	313	10
194	6174	168	38	64	64	171	13	36	28	80	47	55	16	28	27	26	46	6	45	65	1085.2	334	11
195	6175	162	62	83	79	145	17	42	30	74	56	42	29	31	62	45	63	5	33	72	1244.7	343	11
196	6195	180	58	112	85	154	18	35	21	47	58	61	19	37	36	28	69	5	50	50	873.4	241	9
197	6196	156	54	63	79	145	13	32	18	67	63	41	25	22	34	27	35	6	40	44	778.1	233	9
198	6199	95	38	33	59	38	16	23	17	33	34	36	15	19	28	11	52	2	27	29	844.2	252	9
199	6202	170	55	71	75	132	16	42	28	90	54	44	23	17	32	24	52	5	34	65	1340.1	404	12
200	6204	127	41	84	51	132	13	30	28	55	71	39	16	26	23	26	74	5	60	54	825.1	245	10

OBS	PLANE	X11	X12	X13	X14	X22	X24	X41	X42	X44	X45	X46	X47	X49	X51	X52	X61	X65	X71	X72	HRS	SORT	MO
201	7014	180	73	113	63	168	9	42	27	82	60	39	15	21	32	16	63	2	30	43	1239.5	359	12
202	7016	195	53	73	76	141	14	29	29	74	55	36	21	22	45	36	81	5	44	79	1482.2	384	12
203	7944	141	49	61	53	126	7	48	21	51	53	35	24	21	34	21	52	9	33	43	365.3	202	11
204	7948	179	75	131	86	233	35	45	28	125	66	44	39	49	29	45	85	9	52	59	1138.4	294	12
205	7949	161	67	101	67	123	17	36	18	83	56	52	31	30	34	21	57	2	36	52	1169.6	.	12
206	7950	182	52	69	66	190	22	27	9	68	44	47	12	38	36	21	60	6	49	39	1093.9	254	12
207	7951	199	82	86	86	240	8	49	15	66	53	45	19	35	37	36	80	8	42	48	1191.8	359	11
208	7952	92	23	69	41	121	10	16	12	38	30	58	8	27	36	21	64	4	46	58	1368.3	364	12
209	7953	183	54	98	83	186	36	36	15	89	52	26	15	51	32	41	66	1	34	48	1458.5	343	12
210	7954	186	77	130	37	182	9	34	17	115	50	40	24	48	49	19	56	7	48	75	1235.9	319	12
211	7955	194	66	112	54	158	30	27	26	92	47	27	18	36	44	39	54	4	46	59	1084.2	302	12
212	7956	126	53	113	53	123	21	18	28	44	36	40	20	32	34	22	44	0	26	36	1411.3	444	12
213	7957	114	26	42	42	129	16	18	22	58	49	27	21	17	35	37	40	1	29	43	1240.9	307	12
214	7958	194	53	100	69	165	22	17	17	45	28	42	19	29	38	22	72	6	28	35	1128.8	292	12
215	7959	137	35	66	54	103	18	18	12	54	37	31	19	24	22	29	70	3	29	48	1274.5	365	12
216	8075	222	59	68	80	206	19	41	29	65	40	30	9	42	57	27	64	5	33	68	1154.7	291	12
217	8076	184	52	85	83	140	15	34	20	68	46	20	21	30	40	47	58	0	32	80	1270.3	327	12
218	8078	210	63	116	53	169	12	46	15	88	54	22	29	32	40	40	77	7	42	80	883.6	251	10
219	8079	147	37	69	57	11[illegible]	12	23	23	53	39	30	10	22	44	41	77	7	41	49	1052.0	303	11
220	8080	168	53	75	66	141	16	24	25	56	51	39	24	22	38	14	52	4	34	34	945.0	246	12
221	8081	209	62	114	82	129	19	39	15	112	61	21	12	35	48	38	50	21	40	58	873.2	252	11
222	8082	107	24	56	52	79	3	41	10	39	22	28	27	19	38	33	69	4	44	41	1105.1	324	12
223	8083	119	39	72	59	161	15	50	24	65	41	37	18	40	38	47	53	8	47	60	1108.4	268	11
224	8084	107	40	93	60	139	15	30	11	59	43	18	13	18	25	34	52	0	18	43	1189.5	328	12
225	8085	129	23	68	41	146	6	24	16	38	29	13	9	17	34	36	62	3	25	52	1261.1	340	12

OBS	PLANE	X11	X12	X13	X14	X22	X24	X41	X42	X44	X45	X46	X47	X49	X51	X52	X61	X65	X71	X72	HRS	SORT	MO
226	8086	153	27	73	70	124	8	38	29	43	31	43	19	17	34	55	36	1	59	51	1303.0	379	12
227	8087	91	26	60	57	108	18	24	12	29	19	20	12	16	29	26	42	11	34	48	1092.6	268	11
228	8088	173	62	49	68	108	19	37	16	56	27	30	19	26	25	23	70	2	20	47	1228.8	318	12
229	8089	185	54	92	83	147	14	33	18	52	72	29	13	37	42	34	63	4	38	56	1380.9	348	12
230	8090	260	112	139	75	211	43	44	22	170	98	43	39	53	57	42	94	10	44	64	1682.8	436	12
231	9398	160	44	96	93	177	18	25	17	79	33	33	22	28	39	23	62	6	37	43	1199.6	291	12
232	9399	129	34	71	60	109	7	18	15	37	41	25	9	14	38	27	61	3	39	60	1132.0	401	12
233	9400	136	35	81	59	103	10	26	15	39	44	69	18	13	40	41	86	4	51	67	1011.5	295	11
234	9403	70	26	19	29	61	1	10	15	11	17	14	5	10	7	11	16	2	17	12	813.8	186	9
235	9404	120	48	83	59	91	12	30	15	39	51	42	2	24	26	36	62	6	31	52	587.2	162	12
236	9405	384	117	180	193	292	36	36	39	94	60	37	16	32	50	26	46	5	45	57	1440.6	437	12
237	9406	149	45	91	79	127	13	29	20	71	38	51	20	32	48	25	55	3	38	79	623.7	166	11
238	9408	306	84	166	188	303	36	29	23	79	54	33	15	24	34	45	72	11	33	68	1243.0	339	12
239	9409	136	54	72	75	133	16	26	30	82	32	43	20	19	39	28	43	9	39	50	1257.3	337	12
240	9410	142	62	108	59	182	34	31	24	112	66	41	38	37	45	33	64	2	35	69	1077.0	305	11
241	9411	165	44	109	66	139	16	26	17	59	52	40	19	31	28	35	49	3	34	53	1087.9	295	12
242	9412	245	80	133	63	171	12	28	14	126	56	42	18	44	24	30	56	4	23	79	1068.9	280	11
243	9413	180	62	104	42	128	21	49	19	107	35	32	25	31	30	21	53	3	26	61	919.8	250	11
244	9414	184	80	91	81	112	18	18	19	98	55	23	9	34	28	31	35	4	43	50	1060.0	282	12

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